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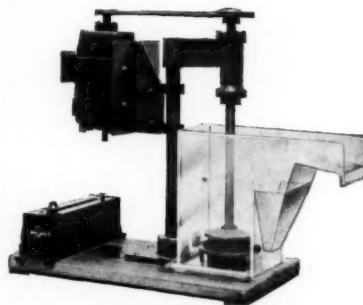


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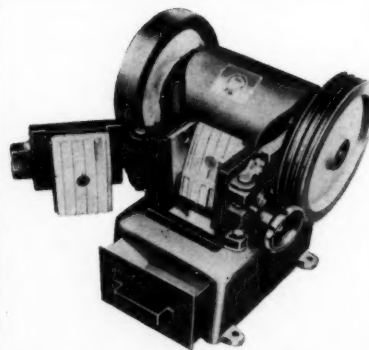
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# The Mining Journal

London, November 6, 1959

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## Exploration by Government Contract

**D**ESPITE the pleas of American producers for increased protection against competition from imported ores and metals, the basic consideration influencing United States mineral policy is the dwindling proportion of the national requirements which the domestic mining industry can supply.

Although, in terms of aggregate value of output, the U.S. still ranks as the largest mineral producer in the world, the discovery of new reserves has failed to keep pace with the spectacular growth in consumption. America's potential resources remain immense, but the known reserves include vast tonnages which are too low in grade to permit of economic recovery at present prices and by existing techniques. As the world's largest copper producer, its second largest zinc and silver producer, and its third largest lead producer, the United States can scarcely be termed a "have-not" nation, but the fact remains that she has been obliged to import a growing proportion of her requirements of ores and minerals.

The situation is not one that can be remedied by reserving a larger share of the American market for domestic producers through such questionable expedients as tariffs or import quotas. There are two obvious directions, however, on which a constructive approach to the problem of mineral resources can be made, namely by the location of new deposits and by lowering the limits of payability through advances in mineral dressing and extractive metallurgy.

Most of the easily located deposits within the United States have been found and developed, and new deposits of payable grade are becoming increasingly difficult to locate. It is evident that if America is to continue producing substantial portions of its own requirements, increasing emphasis must be placed on exploration. One way in which the Government is endeavouring to encourage exploration is by sharing the financial risk through a programme administered by the Office of Minerals Exploration, which enters into contracts with private parties in respect of 32 strategic and critical minerals and metals.

O.M.E. is the successor of the former Defence Minerals Exploration Administration, which terminated on June 30, 1958. During eight years of operation D.M.E.A. granted financial assistance in the discovery of mineral reserves having a net recoverable value of \$625,000,000, based on current market prices. As of June 30, 1959, the U.S. Government had received \$3,127,068 in royalties on ore shipments from D.M.E.A. projects, which had a net recoverable value of approximately \$64,100,000. At the same date, the total funds paid and committed for the D.M.E.A. programme amounted to approximately \$36,541,465.

The O.M.E. application forms were made available to the public in January, 1959, and more than 1,200 requests for these forms have been received. In its second semi-annual report, covering operations from January-June, 1959, O.M.E. states that by June 30 eight contracts had been received, calling for expenditures aggregating \$180,590, of which the Government's share was set at \$90,295.

Contracts require specific work to be performed by the operator within a described area of land. The work must be completed during a fixed period at costs estimated on an actual or fixed unit basis. The maximum cost of the proposed work in which the Government will participate is set out in the contract, the Government's contribution being 50 per cent of this amount but limited in any single contract to \$250,000. Contracts are approved only after careful investigation, using sound engineering and geological principles. Usually contracts are not approved for work that requires more than two years to complete, the time limit for most contracts being fixed at a much shorter period.

Factors taken into account in considering applications are as follows: the geological probability of a significant discovery; the estimated cost of exploration in relation to the size and grade of the potential deposit; the plan and method of conducting the exploration; accessibility of the project area; the background and operating experience of the applicant; the applicant's title or right to possession of the property; the non-availability of funds from commercial sources on reasonable terms; and whether the applicant would normally undertake the exploration at his sole expense under current conditions.

The contract provides for repayment of the Government's contribution with interest by a royalty on production. If there is no production there is no obligation to repay.

O.M.E. operates under the general policy direction of the Assistant Secretary—Mineral Resources. It employs a small staff in Washington and two field auditors to administer its programme and liquidate the D.M.E.A. programme. The services of the staffs of the Bureau of Mines and Geological Survey are used for all field examinations, reports, progress inspections, and field administration.

Like its predecessor, the D.M.E.A., the O.M.E. programme appeals particularly to small businesses. Many small operators, whether individuals, syndicates or companies, are especially interested in exploring for highly strategic minerals not found in the U.S. in deposits of sufficient size to be of interest to large concerns. All the participants in the O.M.E. programme to date are classed as small businesses. The largest O.M.E. contract calls for a maximum expenditure of only \$47,910, while 62.5 per cent of the contracts call for expenditures by the operator of less than \$7,000 of his own funds or the equivalent value in his labour, supervision, or equipment to complete the exploration.

Although O.M.E. itself is still very young, sufficient has already been achieved to indicate the need which existed for some form of machinery whereby the small operator could be assisted to play an active part in minerals exploration, a need which is by no means confined to the United States. In the aggregate, prospects too limited in extent to interest the big battalions can become a most useful addition to national ore reserves. Through O.M.E. and its predecessor, D.M.E.A., the U.S. Government has found a means of giving active encouragement to the search for the scarcer strategic minerals at little or no cost to itself. The incentive provided by the O.M.E. programme, in which the Government shares in the risk, is affording a real stimulus to exploration, from which long-term benefits can be expected to result.

## CUBA APPLIES THE SCREW

At a time when many developing countries are endeavouring to create a favourable investment climate for the exploitation of their natural resources, President Castro's Government has gone out of its way to discourage mining enterprise, apparently as an anti-American gesture.

A new mining law just passed by the Cuban Cabinet

empowers the Government to order the reactivation of any inactive mine considered to be of national interest. Failure of a concessionaire to resume operation of the mine within 60 days after receiving notification will automatically mean cancellation of concession rights and the transfer of the mine to government ownership.

The law creates a Minimum Development Fund which will derive its income from payment of \$100 for the re-registration of each mine and the payment of a royalty or tax of \$20 annually per hectare for mines not under "adequate exploitation". By what we are tempted to describe as a classic example of fiscal irony, it will also be financed by a tax of \$10 per hectare on mines which are "adequately exploited".

It is further provided that, in addition to the annual tax based on the area covered by concessions, concessionaires must pay the Government 5 per cent, in cash or in ore, at the discretion of the Government, on the estimated value of the mineral involved. The value will be based on the highest average price registered in world markets. The law also specifies that when minerals are exported the Government tax will be 25 per cent of the value of the minerals exported.

These new measures come at a time when Freeport Sulphur's Moa Bay nickel project is just starting production. Understandably, the company has declined to comment on the law until it has been fully studied, but it seems evident that the imposition of new taxes which, under present conditions can scarcely be passed on to consumers, cannot fail to affect the profitability of the Moa Bay operations.

The Nicaro nickel plant, owned by the U.S. Government, and valued at about \$85,000,000, is covered by a special agreement between the two governments and is unlikely, therefore, to be affected for the present. Cuba's action, however, will certainly make it no easier for the U.S. Government to sell the Nicaro plant, for which purchase proposals have been invited, since any prospective purchaser would have to make his own tax agreement with the Cuban Government. Hitherto Nicaro has been exempted from most taxes in that country. About half-a-dozen bidders are believed to have sent in purchase proposals, which were scheduled for public opening in the very near future.

Another U.S. company vitally affected by the new taxes is Bethlehem Steel, whose extensive ore fields in Cuba have never been completely explored and developed. They are known to contain iron ore as well as nickel and cobalt, the nickel content alone being valued at over \$30,000,000 in hearings before Congress last year.

## GEOLOGICAL RESEARCH IN BULGARIA

The Sofia newspaper *Otechestven Front*, daily organ of the governmental coalition "Fatherland Front" of Bulgaria, published on October 29, an interesting account of the constitution, functions and working of the Geological Institute of the Bulgarian Academy of Sciences.

The Institute has a staff of 77, inclusive of technicians and clerical personnel, and three laboratories, the most important of which, the geochemical laboratory, is one of the best in Bulgaria, with all the most modern equipment. It is there that all minerals, etc., are sent for analysis. The others are a geological engineering laboratory, and a laboratory for the analysis of mineral waters, in which Bulgaria is rich.

The Institute does a great deal of research work in connection with irrigation, road-making and building, but its most important work is, of course, in connection with mining. It is engaged in prospecting in the regions round Vratsa, Ternovo and Madan, and will start work also in the Osogov metal basin next year, combining with this

research into volcanic conditions of the past which have determined the distribution of various minerals. Its most important recent work has been in relation to rare and scattered metals of economic importance, such as indium, germanium and caesium, as well as cobalt and nickel, and in the investigation of sedimentary deposits in which non-metallic minerals, such as phosphorite and bauxite, are to be found. Its systematic work on the production of geological charts of the earth's crust is now bearing fruit, especially in Northern Bulgaria, where it is facilitating the location of petroleum deposits.

#### INDIA'S PERSONNEL NEEDS

Four hundred additional geologists, 2,600 drilling engineers, and 3,000 mine managers will be required if coal production is to reach the target of 100,000,000 tons, tentatively fixed for the plan, according to the Coal Council of India's committee on production and preparation. In order to overcome the shortage in technical personnel, the committee is reported to have made several important recommendations, which include the introduction of a mining engineering course in all engineering colleges, provision of facilities for young Indian students to study mining engineering in foreign universities, the obtaining of the services of mining engineers and teachers from abroad, and the adoption of a system of granting certificates in mining for a three-year course at the Indian School of Mines, Dhanbad, with a view to turning out more trained personnel. The Government of India has already decided to embark on a programme of training the requisite personnel well in advance. Four training schools are being opened at Giridih, Kargali, Talcher and Kurasia.

#### MINERALS PROJECTS IN ISRAEL

Copper at Timna in the Negev region, iron at Manara in Galilee, flint clay in the Makhtesh Ramon area of the central Negev and possibly the newly prospected phosphate deposits will demand before long a very considerable underground mining effort. In its final report the Technological Advisory Board, under the chairmanship of Sir Ben Lockspeiser, expresses the view that training facilities in Israel for mining engineers, mining technicians, and underground miners are quite inadequate for the purpose. Development schemes in this field may be strangled at birth for the lack of suitably trained personnel. It is suggested that the Ministries involved treat the whole matter as a serious problem.

The report states that a draft agreement has been reached between the Israel Government and a British company with regard to design and construction of a 10,000 ton per annum phosphorus plant. This agreement includes the purchase of know-how and commercial scale electro-thermal furnace trials of Israeli phosphate ore in one of the British company's works with a view to establishing operation conditions. A large scale pelletizing trial has been successfully concluded. Commercial scale electro-thermal furnace trials are in progress in the United Kingdom. It is anticipated that these trials will be completed and the results evaluated early in 1960 to enable a final decision to be taken on this project.

Considerable effort has been directed to improving the efficiency of existing plants and processes. In particular, an alteration has been worked out in the existing dicalcium phosphate process, leading to economies in raw material consumption. Pelletizing of local phosphate rock and silica, required in the production of elemental phosphorus, has been investigated with satisfactory results.

Reviewing the progress made by the various Negev development industries, the Minister of Development recently reported

that the export of Israel phosphates would total 100,000 tons and would bring in some \$800,000 during the current fiscal year, whereas last year's phosphate exports only reached 40,000 tons. Negotiations are at present under way with a Far Eastern country for the export of 100,000 tons of phosphates. According to the Minister, progress at the Oron Phosphate plant has enabled the company to cover all its costs during the last six months. In about a month's time, a new flotation plant will be added to Oron which will raise the  $P_2O_5$  content of the phosphate there from 28 to 31 per cent.

Preliminary tests at Ein-Yahav in the Arava region south of the Dead Sea have shown that this area could provide some 100,000 tons of phosphate annually. It has also the advantage of being much nearer to Eilat Port in the south on the Gulf of Aqaba than the Oron phosphate zone. This would cut transport costs by about 30 per cent. The investment needed for the Ein-Yahav development may be about I.£2,500,000.

As regards the Dead Sea Potash Works at Sodom, the Minister of Development disclosed that a plan, prepared by the Zanzibar Co. in the United States, for the expansion of the plant's annual output capacity to some 600,000 tons, had recently been completed, and would require an investment of I.£ 50,000,000 (equal to about £10,000,000 sterling) to cover three years for final completion. The plant's present capacity is about 135,000 tons per year.

#### GERMANY'S ORE PORTS

The two North Sea ports of Emden and Wilhelmshaven, in West Germany are in future to be responsible for the handling of a very considerable amount of Europe's imported ore loadings. With overseas ore loadings now accounting for well over 35 per cent of the total imports of West Germany, the port facilities for ore handling have reached a very high degree of importance. With Emden at present supplying about one-third of the Ruhr iron and steelworks with ore, steps are now being taken to turn the nearby Wilhelmshaven into "Europort No. 2", Rotterdam being in the process of becoming "Europort No. 1". The advantage of building up Wilhelmshaven as a port for large-scale ore traffic is that both depth of harbour and sufficiency of loading and unloading facilities make possible the handling of large ships there—and the tendency is for ore-bearing ships to grow larger and larger. The reason for this as far as ore is concerned is that it has been proved that the larger the ship the cheaper the ore to the consumer; to such an extent is this true that, according to German sources, from 15 to 20 per cent of transport costs can be saved by operating a 100,000-tonne ore freighter and not one of 60,000 tonnes. Future large ore vessels from non-Continental countries are expected to be between 40,000 and 100,000 tonnes in capacity.

It is now intended that the present vessel capacity of Emden, should be expanded from 20,000-tonne units to vessels of from 30,000 to 35,000 tonnes, while Wilhelmshaven prepares to handle larger units. This will mean virtually that the two ports will between them be able to handle the whole range of ore vessels which can dock, Wilhelmshaven specializing in the larger tonnages which Emden cannot handle. A third North Sea port, Bremerhaven, is at present engaged in extending its vessels capacity to 30,000-tonne units.

The Ruhr consumers are particularly interested in the development of Wilhelmshaven for the obvious reason that the use of large-capacity ore vessels would save them money. They are urging the running of a new canal from the port area of Wilhelmshaven to join up with the heavily-used inland waterway, the Dortmund-Ems Canal, at the same time suggesting that the opportunity should now be taken to make such alterations to the Dortmund-Ems Canal as to permit the operation on it of ships of up to 2,000 tonnes.

# Mineral Resources of Paraguay

**P**ARAGUAY possesses large quantities of certain non-metallic mineral resources, notably clays suitable for brick, tile and pottery; limestone and other raw materials for portland cement and for lime; common and ornamental building stones; glass sand; talc; and mineral pigments. Supplies of all these materials appear to be more than sufficient to meet all conceivable domestic requirements.

Except for iron ore, of which there are many small but rich deposits, the country appears to be very poorly endowed in most other mineral resources, metallic and non-metallic. It has a little manganese, copper, mica and beryl, but unless larger and richer deposits are found in the future than have been in the past, none of them seem to offer much promise. There is some slight chance that rumours of the existence of gold, tin, tungsten, lead and mercury, and gem stones may yet be substantiated by actual discoveries or rediscoveries, but the possibility of finding large or rich deposits of any of them is rather remote. There are, however, good geological reasons for hoping that worthwhile deposits of salt, gypsum, and bauxite may yet be uncovered.

## Base Minerals

A vein of barytes reportedly exists at or near Fuerte Olimpo, on the upper part of the Rio Paraguay. It is said to have been examined by the Union Oil Co. as a possible source of material for heavy drilling mud, but was not developed by this company. Some studies have also been made by other groups, but high costs of transportation, tariff difficulties, and other economic factors have discouraged any active exploration.

Bauxite is reported from San Juan Nepomuceno, Altos, Piribebuy and Paraguari. No bauxite was seen by the author of the report but he considers that, in view of the deep weathering and laterization of most of the rocks in eastern Paraguay, deposits of bauxite or high-alumina clay are to be expected. The alkalic rocks, such as the shonkinite at Mbocayaty and the phonolite and nepheline syenite elsewhere, are of special interest in this regard. Weathering and laterization of similar rocks in Brazil and elsewhere have yielded large deposits of bauxite of commercial grade. The author knows of no places in Paraguay where these alkalic rocks are weathered to laterite, but it would be surprising if no such weathered zones existed. Because of the lack of fuel and power locally, only large deposits that could form the basis of an export industry would be of interest. A determined search for such deposits appears to be worth while.

Of the several copper deposits that are more or less reliably reported, only one—the Paso Pindo deposit near Villa Florida—was seen by the author. Small amounts of malachite, azurite and native copper are persistently reported from various localities. The widespread belief that Paraguay is rich in copper is supported in part by reports such as these and in part by the legend that the early Jesuits produced bronze implements of many kinds.

Small amounts of copper are unquestionably present in some places, but most of the reported occurrences are unsubstantiated by specimens or assay results. It seems almost certain that many, if not most, reports are based on the fact that the cavity fillings of bright-to-dull-green chlorite so characteristic of the Serra Geral basalt have been mistaken for malachite or other green minerals of copper. It is reasonable to suppose that the reported

*This information is extracted from "Geological and Mineral Resources of Paraguay—a Reconnaissance," published by the U.S. Government Printing Works, Washington, as Geological Survey Professional Paper 327. The author, Edwin B. Eckel, was assigned by the U.S. Geological Survey in 1952 to act as geological technical adviser to Paraguay under the auspices of the Institute of Inter-American Affairs. His conclusions as to prospects for locating extensive occurrences of payable minerals are largely pessimistic*

production of bronze implements by the Jesuits represents remelted and recast Spanish bronze, particularly since the legends fail to account for the tin that is an essential constituent of bronze.

The Paso Pindo deposit has been explored over an area of 50-100 sq. m. by test pits and shallow opencuts. There is no well-defined vein and little or no evidence of strong alteration or large openings that would have permitted the entrance of ore-bearing solutions in volume. A few pounds of high-grade carbonate ore have been mined and sorted by hand in the past. More may yet be found in depth or along the strike of the fracture zone, but the outlook for a large or rich deposit is distinctly unpromising.

## Industrial Minerals

No commercially valuable sources of gypsum are known to exist. It seems entirely possible, however, that gypsum, like salt, might be found somewhere within the continental beds that underlie the Gran Chaco. In view of the comparatively small but continuing need for gypsum for plaster and for cement-making, cautious exploration by means of deep, carefully drilled wells may eventually be justified.

Many rich but comparatively small deposits of hematite and magnetite are known in Paraguay. So far as is known, however, there are no extensive deposits of bedded iron ore such as constitute resources of major importance in Brazil and in Venezuela. Nevertheless the hematite-magnetite deposits of Paraguay do have considerable potential value, at least to the local economy.

Although available evidence is scanty, mica appears to be widely, and perhaps abundantly, distributed in the Precambrian rocks in the northern part of the country. It seems probable that most of the material will be suitable only for scrap mica. There is a possibility, however, that good grades of sheet mica may exist in some places. Even if promising deposits should be found, questions of economics, of transportation, and of living conditions in this remote and large unsettled region might play a larger part in the workability of the deposits than would the intrinsic value of the mica itself.

## Fuel Resources

Inasmuch as the Gondwana beds contain coal in other parts of South America and elsewhere, it is entirely possible that some of these beds in Paraguay are also coal-bearing, but no authenticated occurrences have been reported.

Deposits of peat are known in some of the swampy areas along the Rio Paraguay near Pilar, and are reported to

be large. During 1952 plans were being laid to develop and exploit these deposits. In view of the serious shortage of fuel in the country, the extent, fuel value and usability of the peat resources should be determined, and other deposits should be sought in similar geological settings.

Except for one or two reported oil seeps in eastern Paraguay, and showings of oil and gas in one deep well in the Gran Chaco, Paraguay has no known deposits of petroleum or natural gas. There are some reasons for believing, however, that resources of these commodities may yet be discovered beneath the Gran Chaco plains.

### Gem Stones and Precious Metals

There is a possibility, though only a remote one, that small quantities of precious or semi-precious gem stones may some day be found in Paraguay. The reported beryl in some of the pegmatites in the Rio Apa region naturally indicates the possibility that, as in Brazil, some may be in the form of emerald or of aquamarine.

Similarly, comparison of the general geological relations in eastern Paraguay with some of the diamond-bearing areas further north in Brazil, suggests that the basal conglomerate beds of the Lower Silurian Caacupé series, which locally mark the contact between these beds and the Precambrian granitic rocks, might yield stream-worn diamonds to thorough search. Such search, if attempted, should be done in the full realization that the chances of finding diamonds are extremely slim.

Many of the beautiful amethysts and agates produced in Brazil and Uruguay are derived from cavity fillings in the Serra Geral basalts that are apparently identical with those that cover a large part of south-eastern Paraguay. Some beautifully coloured agates and a few pale but otherwise gem-quality amethysts have indeed been collected in Paraguay. Active search would doubtless serve to discover additional material, though it is impossible to say in what quantity or quality.

There are, almost inevitably, many legends to the effect that rich deposits of gold and silver were found by the early explorers and priests who settled in Paraguay. Though it is certain that these people sought the precious metals vigorously, there are no authentic records that they were successful. Reports of gold and silver discoveries are still made occasionally, but, so far as is known, none has been substantiated. The possibility that precious metals exist in paying quantity cannot be denied, but in view of the record to date the outlook is distinctly unpromising.

### General Conclusions

For nearly four and a half centuries many men, some highly skilled in their profession, have sought mineral wealth in Paraguay. It is easy to believe that all of them may have missed the obscure or the deeply covered deposit, but almost inconceivable that all would have failed to discover obvious deposits that would be most easily found and developed. The fact that they have not done so is in itself strong presumptive evidence that easily discovered deposits do not exist.

So far as the geology is now known, the Precambrian rocks offer the best chances of discovering deposits of metallic minerals. Unfortunately, these rocks are covered in most places by barren sedimentary rocks or by swamps, and many of the exposures that do exist are remotely situated and difficult to explore. None of the younger igneous rocks appear to be of the kinds with which ore-bearing solutions are usually associated.

These conclusions are at variance with popular beliefs within the country, which are based in part on the inevitable enlargement of legends with time and partly on failure to distinguish between mineral occurrences and mineral resources. The belief in existence of gold and silver resources, for example, seems to be based entirely on stories that the early Jesuits found and produced fabulous quantities of these metals. Again, the almost universally held belief that Paraguay is rich in iron is based on the well-known fact that local mines and furnaces produced all the iron needed in Paraguay's epic struggle against three powerful adversaries — Argentina, Brazil, and Uruguay — during the War of the Triple Alliance. Though Paraguay does possess rich iron deposits, there are many reasons, geological and otherwise, for believing that they are far too small, individually and collectively, to form the basis of an export business.

Too many beliefs in mineral riches are based on small specimens, with little or no proof that they represent workable quantities of ore. The author's pessimism is also based partly on the fact that most specimens of metallic and other minerals or ores which he has seen are far below commercial standards.

Present knowledge strongly indicates that Paraguay is relatively poor in mineral resources. Details of the geology are imperfectly known, however, and many parts of the country are so inaccessible as to have escaped very careful search. Further exploration, therefore, seems justified.

### Recommendations for Further Prospecting

In searching for deposits of the metallic minerals, and many of the non-metallic ones, it is always well to proceed from the known to the unknown. The best chances of discovering more iron ore, for example, will lie in further exploration, in depth or laterally, of known deposits. The second rule should be to confine the search to favourable geological settings. So far as is known, nearly all the metallic deposits, as well as all the talc, pyrophyllite, beryl and mica, are associated with Precambrian rocks in the Rio Apa and Amambay regions and in the general vicinities of Caacupé and San Miguel. Conventional methods of prospecting should be followed in most cases. In the search for iron ores, however, it is probable that geophysical methods might serve to discover orebodies not exposed at the surface.

Few, if any guides, can be given for hunting new deposits of clays, building stones, or bauxite. It is suggested, however, that serious prospectors take account of the deep weathering that characterises most of the rocks, and prepare to expose unweathered material by trenches, pits, or soil augers.

The shortages of fuel and power in Paraguay are so acute that serious efforts to alleviate them seem justified. There is a good possibility that commercial quantities of petroleum exist in places beneath the Gran Chaco. In view of its potential importance to the national economy, serious efforts to search for it should be encouraged. Present efforts to develop the peat deposits near Pilar deserve strong support. There is little reason to expect authentic discoveries of coal, but every reported discovery should be followed up, as should reports of salt and sulphur deposits.

There is an excellent possibility of establishing several small new industries, or of modernizing existing ones, using local mineral resources and producing goods for local consumption. Among their long-range benefits, such industries would encourage the search for mineral resources and develop skills on the part of Paraguayan workers in mining and treating mineral deposits.

# G.E.C.'s New Mineral Dressing Laboratory

**C**OMPLETE ore treatment plants, with all associated equipment, are manufactured at the mechanical engineering works of the General Electric Co., situated at Erith, Kent. Before quotations for capital expenditure are made, it is desirable to carry out tests on a sample of the ore, since every ore has its own particular characteristics.

The investigations of a mineral dressing laboratory are particularly important for a new mining project or for one that is being reorganised and expanded. Although the cost of the separation equipment may not be a major item, this part of the plant is the key to the whole project. The function of the laboratory is to find a process or combination of processes giving an adequate recovery of a product that will meet market specifications or the demands of a smelter. If the laboratory work is successful, plant layout and design can follow.

Since 1930 this work has been carried out in a mineral dressing laboratory, which formed part of G.E.C.'s research laboratories at Wembley, Middlesex. Its functions and equipment were described in *The Mining Journal*, June 14, 1957.

For some time, ever-increasing demands of space at Wembley, coupled with the reorganisation of the mining department at Erith, have given rise to serious consideration of the position of the mineral dressing laboratory. It was eventually decided that there was much to be gained by transferring this laboratory to Erith, especially since many valuable facilities of the Wembley laboratories, including analytical services and X-ray diffraction for the identification of minerals, would still be available. This has now been accomplished, and advantage has been taken of the move to add to and expand the range of the laboratory equipment, which now covers an even wider field than before. The increased floorspace available, as well as the greater number of rooms, facilitate the layout of plant and equipment and permit improved organisation and control. A further important advantage is the proximity of the engineering and sales departments at Erith, with whom closer co-operation can now be maintained. One of the primary objectives of the laboratory is, of course, to promote sales of mining machinery.

Whereas the original laboratory at Wembley was set up for flotation work and simple gravity concentration, it has grown to such an extent that practically all ore treatment and coal preparation processes can now be carried out. In addition to testing work, a continuous development programme for new machines and processes will be undertaken.

## Layout and Equipment

The new laboratory occupies a double storey building, and it is envisaged that there will ultimately be a staff of seven, of whom four will be university graduates. One end of the building is for wet work and the other for dry. Offices and balance room are on the upper floor and there is a small workshop on the ground floor.

Primary crushing is performed in a jaw crusher which can take 2 in. pieces. If a large batch has to be broken down, the product from the crusher can be discharged into a Sherwen spiral conveyor in which it is elevated to a Sherwen screen, crushing and screening being completed in a single operation. Secondary crushing can be carried out with rolls if desired, but, as the jaw crusher is comparatively small, it can easily make a product suitable for ball or rod mill feed, and so rolls are seldom used. Batches of ore are handled in standard steel pans by means of a Slingsby pan truck and a hydraulic lifting device. A disc grinder is available for fine grinding of assay samples but is not used for preparing ores for treatment.

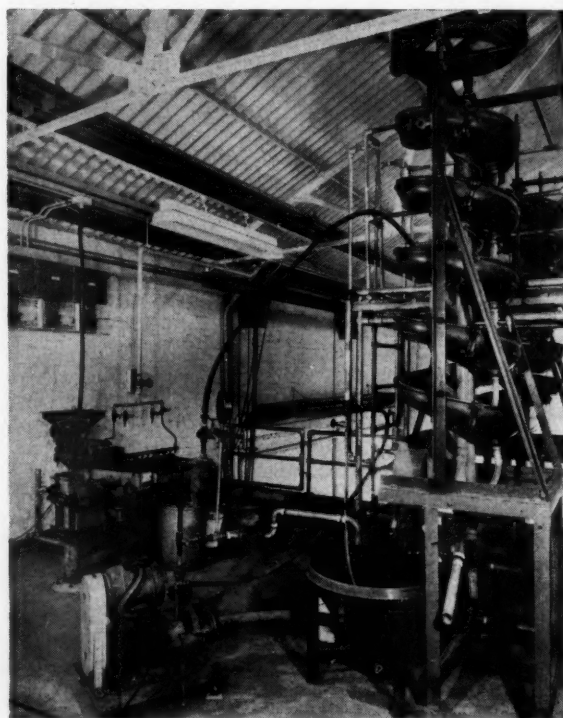
Coarse ore can be treated by heavy-medium separation or in a jig. The H.M.S. machine is a very effective unit with a 20-in. dia. separating cone, a Sherwen screen and a Wilfley pump. Ferrosilicon or magnetite are normally used for making the medium in which separation takes place and a separating density as high as 3.5 can be reached. Feed up to  $\frac{1}{2}$  in. in size, and sometimes up to  $\frac{3}{4}$  in., can be treated. The jig unit works well with  $\frac{1}{2}$  in. feed but is too small to take larger material.

Fine ore and coal can be concentrated in Humphreys spirals, on a shaking table or by flotation. The spirals are full-size commercial units which can be run either with a continuous feed or, for relatively small samples, with a batch feed in a closed circuit. The table is a small-scale machine for continuous running, with circulation of middlings if required. Flotation is carried out in batch cells of various sizes.

A wet magnetic separator is available either for treating ores containing highly magnetic material or for cleaning magnetic media used in the heavy-medium separation machine.

Dry processing can be done in a high-intensity magnetic separator of the cross-belt type or by high-voltage (electrostatic) separation in a laboratory-size unit, both machines being capable of continuous operation.

Preparation of ore for processing can be carried out by grinding and classification. Laboratory grinding procedure has been developed to a stage of high efficiency. It can be carried



out in batch or continuous mills, with either balls or rods, in open or closed circuit. A special hydraulic classifier has been developed which can be used either for batch or continuous sizing and can be incorporated with the grinding unit when closed-circuit operation is required. In addition, a conventional 3-in. cyclone unit is available for classification or desliming either by batch or continuous operation.

A rotary vacuum filter is used for dewatering solids during preparation and separation procedures. It can be used when required for filtration tests. Batch filters are employed for dewatering small samples and ovens are provided for drying the products made during the testing programmes.

Control equipment includes a Rotap sieve shaker and standard sieves, a Haultain superpanner and a Franz magnetic separator. These, used in conjunction with microscopic inspection, X-ray diffraction, and chemical analyses are invaluable for examining new ores and for assessing the results of treatment.

### Services

The building has a.c. and d.c. electrical supplies; compressed air comes from the works main and is reduced to any required pressure by a regulator in the laboratory; vacuum, mainly for filtration, is supplied by a wet vacuum pump; water comes from a steady-head tank which eliminates pressure variations.

Above is a section of the wet laboratory on the ground floor of the new Mineral Dressing Laboratory at the Erith Works of The General Electric Co., Ltd.

Below are two Humphreys spirals and the small concentrating table used for the concentration of fine ore and coal at G.E.C.'s Erith Works

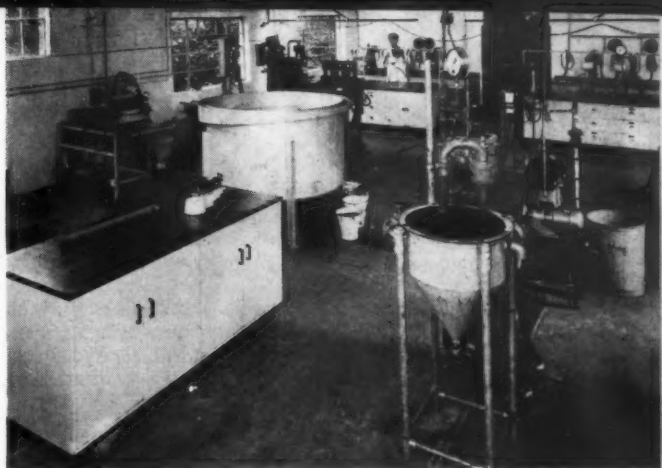
Much of the laboratory equipment is portable and has been designed for plugging in at any convenient point so that machines can readily be assembled into various combinations, such as a rod or ball mill, classifier, circulating pump and feeder. All equipment is kept ready for use at a moment's notice so that attention can be concentrated on the technical aspects of ore treatment and no time is lost in devising ways and means of linking up the various units.

### Development Programme

Apart from determining the most suitable dressing processes for the ores under investigation, workers at the mineral dressing laboratory are continually studying the performance of the processing equipment used in testing. Experience gained in the laboratory has led to a number of refinements and improvements some of which are now being adopted by the company on a commercial scale. Attempts are also being made to develop machines of new or modified design to fill indicated gaps in the available range of ore treatment plant.

Laboratory studies have led, for example, to the development of an improved type of high intensity magnetic separator, in which each magnet unit has its own conveyor belt, the speed of which is individually controlled. Similarly, an extremely compact high-voltage power pack, encapsulated (potted) in rosin, and thus completely immune from humidity, has been developed for use with a new high-voltage "electrostatic" separator, and is now available commercially.

Work is currently proceeding on an experimental H.M.S. machine of novel design. The limiting factor in machines of



the usual cone type is the diameter of the air lift for carrying the solids, which, if the size of the cone is to be kept within practical dimensions, cannot be much greater than 3 in. The machine under development is essentially a drum and is intended to treat pieces up to 10 in.

Also to be seen in the laboratory is a working model of the new "Jar-Bar" non-clog grizzly feeder, which G.E.C. are now in a position to supply. The machine is similar to the conventional roll grizzly, except that the rolls are elliptical in shape with the major (or minor) axes of each one at right angles to the next so that the gap between them remains constant. As they revolve they lift the lumps of rock and at the same time move them forward with a positive action that is not possible with plain rolls. The jarring motion not only screens out fines, but also works any sticky clay through the gaps between rolls. The machine is, in fact, a scalping grizzly which cannot clog with sticky ore. Standard and heavy-duty types are made with capacities ranging from 175 to 5,000 t.p.h. Settings between rolls are adjustable from 1½" to 10".

## Perlite in Hungary

A report issued by the Hungarian Chamber of Commerce in Budapest states, that, with the aid of Government investments, the perlite industry of Hungary is being expanded considerably and rapidly. Hungary, otherwise generally poor in minerals, has good stocks of perlite and has become one of the world's leading exporters of it. Perlite stemming from Hungary contains more  $\text{SiO}_2$  in its make-up than the American material—73.6 per cent as compared with 69.8 per cent in the United States—and correspondingly less of the other constituents.

Recent investments by the State in this industry have been headed by the mechanization of the open-cast perlite mine at Pálháza and the installation of drying and pulverizing plants beside the site. For the past few months expanded perlite has been produced at a very satisfactory rate at Nyiregyháza and similar plants are at present being built on several sites. As the quality of Hungarian crude perlite is said to be very high with "dead stone" at a minimum, the manufacture of the expanded material is relatively straightforward. Expanded perlite is exported in granule sizes of from 0.3 to 1.5 mm. through the State mineral export marketing board Mineral-imex, main customers being Federal Germany, Holland and Switzerland.

The future is to see further mechanization of perlite exploitation, states the Chamber of Commerce report, as well as progress in the improvement of quality and the opening of new exploitation sites.

# The Fluid Bed Reactor

**D**URING the past 15 years the fluidized bed has developed from a laboratory curiosity to a position of considerable importance in extractive metallurgy, where it is useful for developing gas-solids contacting for physical and chemical interaction systems.

Fluidization principles date back in history, but were only used in commercial unit operation during the early 1940s as the result of extensive development work by Esso Research and Engineering Company in the petroleum field. In 1944, Dorr-Oliver Inc. obtained a licence from Esso for development of the unit process in non-petroleum, non-catalytic fields.

In order to study fluid bed reactors, a symposium was sponsored, in February/March 1959, by the University of Arizona at Tucson, where a one-week educational programme was attended by 41 metallurgists from the United States and Canada, to be joined later by another 60 to 70 delegates.

Of the many points of interest raised during the educational programme those dealing with the size of reactors, freezing, particle size, partial roasting, selective roasting and slugging were outstanding.

In respect of size, it was considered that 10ft. was about the minimum height of a reactor to be used for a 3 to 5-ft. deep bed and that jetting of the bed would probably take place in a reactor less than 10 ft. high, regardless of the diameter. The diameter should be related to the retention time, feed rates, bed height and gas velocity required to carry out the desired physical or chemical reaction.

Almost the only clue to the detection of freezing was erratic temperature readings from several thermocouple taps in the bed. The only remedy for the development of hot spots in a sulphide bed was to cool the reactor and dig the bed out.

It was considered that particle size in fluidization depended on whether the reactions were exothermic or endothermic and on many other variables. Under some conditions, the reactor may tend to act as an air classifier. For extremely fine conditions, the addition of a coarse inert material such as silica sand, may help to keep the bed in fluid condition. With extremely fine feed, flash roasting of sulphides could be a problem. With some fines undergoing endothermic reactions, it may be possible to obtain a surface fusion and a beneficial plastering of fines into larger particles in a fluid bed.

On the question of partial roasting, it was stated that, in a plant under construction at International Nickel Company, at Sudbury, Ont., copper sulphides would be partially roasted on a commercial basis for the production of acid from the gas, while yielding a calcine with a suitable sulphur content for matte roasting. The plant was being designed to handle 2,500 tons per day of copper-nickel concentrate, and flux and would include three 15-ft. diameter Dorrco FluoSolids reactors.

Selective roasting was possible only through the precise temperature controls offered by fluid bed reactors and, by this treatment, complex ores, such as copper zinc, were susceptible to separation. By first selectively roasting, then recovering one metal, followed by a roast of the residue to recover another metal, it may be possible to realize many smelting advantages.

*A symposium on fluid bed reactors was held by the University of Arizona at Tucson from February 23 to March 3. Brief summaries of some of the papers are here presented.*

As regards slugging, or extreme vibrations, pulsations or violent rolling of the beds, little was known, it was said, of the causes or solutions.

## Selection of Reactors

Among the papers read at the symposium was one by Joseph F. Skelly, of M. W. Kellogg Company, on the selection of reactors. He said that in considering reactor selection problems, the systems engineer began by examining the entire mineral handling installation of which the reactor was to be part. It was important for the system and its reactor to be capable of accepting raw materials of variable properties while still retaining the ability to produce a relatively uniform product. These conflicting factors could be accommodated to some extent by a flexible process, relying also on surge capacity.

Waste disposal problems could often influence the choice of a reactor, while energy requirements played an important part in determining the operating cost of any process system, all the types of energy required for the process being taken into consideration. In comparing competing claims for the energy efficiency of various reactor types, it was usually helpful to inquire into the heat exchange facilities used in the cases under study.

Mr. Skelly went on to say that temperature control greatly influenced the choice of reactor since, in general, the fluidized bed provided for much more uniform temperature during reaction than did a fixed bed, shaft and rotary kiln designs and, in general, too, it was easier to control temperature in the fluidized bed than in other types of reactors, provided the desired operating temperature was below the fusion point of any of the solids present in the system. It appeared difficult to maintain a fluidized process when the solids were at temperatures close to the melting point.

In discussing the effect of reactor type on the chemical potential which would make the desired reaction go forward, Mr. Skelly said that this potential was usually greatest when a reactor permitted the counter-current flow of reacting materials. When a reactor was so designed that there was an intimate mixture of the reacting substances with comparatively uniform composition throughout the reaction zone, the chemical potential was generally at a minimum. Counter-current reactors were usually cheaper than continuous stirred tank reactors, since the size, and therefore the cost, was usually inversely proportional to the chemical driving force. The fluidized bed was a continuous stirred tank reactor and thus would be larger for a given chemical job than the counter-current reactor operating at the same temperature. This additional cost factor was often not too significant in evaluating a reactor type since reactor cost was often a relatively small part of that of the total system.

Waste disposal and dust handling might influence the choice of reactor and Mr. Skelly said that fixed bed and shaft reactors, which must be charged with lump or pelletized feed, would usually offer fewer dust recovery problems than would the fluidized power reactor which must necessarily be supplied with finely divided feed particles.

In respect of materials handling, Mr. Skelly mentioned that all high pressure mineral processing reactors must be supplied by intermittent feed conveying equipment since the component engineers had as yet failed to perfect a continuous pumping device capable of moving large quantities of solids through a big pressure differential.

In a paper on "Fluosolids Roasting at Weed Heights" Mr. Henry R. Burch, of the Anaconda Company said that his company operated four fluidizing reactors at its oxide copper leaching plant at Weeds Heights, Nevada, furnishing sulphur dioxide to a 450-ton acid plant by roasting sulphur ore mined at the Leviathan mine. In 1958, this ore averaged 29 per cent sulphur, but ranged from 23 to 33 per cent. Before furnacing, the ore was originally ground in rod mills to -10 mesh. Though experience had shown that a much coarser ore could be roasted, the difficulty in sluicing calcines necessitated grinding so that no more than 25 per cent was plus 10 mesh.

The heat from the burning sulphur was more than sufficient to maintain temperatures in the reactors. Under normal conditions, water was used to hold temperatures to the desired operating range, dome sprays controlling bed and freeboard temperature. The moisture content of the ore, however, had some effect on temperatures.

Mr. Burch said that during a normal operating day about 575 dry tons of sulphur ore was introduced into the FluoSolids plant. This made 400 tons of calcines, of which 200 tons entered the calcine launder from the reactor bed drains, the rest being collected and disposed of in the dust collection system. The reactors were normally operated continuously for about 12 months without major repairs. Only three of the four reactors were in use at any one time, the other being down for maintenance and repair. The extraction percentage of sulphur from the sulphur ore feed to the reactors had been 98.08.

Mr. Henry W. Franz told how the Kennecott Copper Corporation treated pyrites in a fluidizing reactor at Hayden, Arizona, as one step in the production of sponge iron and

of fluidity within the bed. A space rate of 0.75 ft. per second had been considered sufficient to fluidize Bagdad concentrate and tests indicated the need for increased space rate, which would result in an equal increase in the roasting capacity of the reactor. To double the space rate while maintaining the same fluidizing air volume it was necessary to decrease the bed cross sectional area by 50 per cent. This increase in the space rate, plus a suitable feeding method, placed the operation on a continuous basis for testing.

Flotation concentrates varying from 15.93 to 38.63 per cent copper were satisfactorily roasted by changing fluidizing air volume and feed rates. Roasting temperature was the controlling factor governing copper and iron solubilities. Temperatures of 1,300 deg. F. and higher, while decreasing iron solubilities, would greatly lower water soluble copper. Roasting temperatures of from 1,270 to 1,280 deg. F. were considered the most favourable for the production of a high water, sulphuric acid soluble copper calcine, while also holding iron solubility to a minimum.

Mr. Howell said that the Bagdad pilot plant had proved that a defluidized bed was a "dangerous" bed. Inability to refluidize the dormant bed would require partial or complete removal of the bed material, complete removal having to be followed by a preheating and bedding operation before normal operation could continue. Copper sulphate with a melting temperature of 392 deg. F. was the predominant cause of this difficulty and the bed could only be refluidized if the shocking force of the initial refluidizing air volume was sufficiently strong to break the bond holding the particles together. The most successful bed preparation technique involved the

## In Extractive Metallurgy

for the production of strong sulphur dioxide gas for sulphuric acid manufacture. This reactor was normally autogenous in converting iron pyrites slurry to hot hematite calcine. Two auxiliary automatic natural gas burners were used, for starting up after prolonged inoperative periods, to bring the reactor up to operating temperatures, though start-up without these could be achieved after the reactor had been completely down for 72 hours. Reactor bed temperatures were normally held at approximately 1,600 deg. F. and temperatures of at least 1,350 deg. F. were required before the reactor could be started on pyrite feed. To supply one Bruckner furnace, the feed rate was 3.0 - 3.5 tons per hour depending on the grade of pyrite and the gas demands of the acid plant. Three tons per hour, with one bank of cyclones operating, yielded 1.7 tons per hour of hot calcines. The amount of air used depended upon the feed rate and grade of pyrite and was determined by the reactor bed temperature and by the amount of excess oxygen leaving the gas stream.

The operating range for the feed pulp density was between 65-75 per cent solids, said Mr. Franz. Of the total calcine fed to the furnace, about 15 per cent was from bed overflow and 85 per cent from the cyclone collection system. Bed overflow percentage would increase if the pyrite feed were to contain larger sized particles.

On the subject of "Sulphating Copper Sulphides," Edward S. Howell, of the Bagdad Copper Corporation, Bagdad, Arizona, said his company's pilot plant was designed to treat 5 tons of concentrate per day containing about 26 per cent copper, 26 per cent iron and 31 per cent sulphur. It now operated under positive pressure while feeding concentrate slurry. A major problem here had been the maintenance

oxidation of the surface copper sulphate to copper oxide, thereby destroying the tacky coating which would hold the calcine particles together. Mr. Donald MacAskill, Dorr-Oliver Inc., Oakland, Cal., spoke on "FluoSolids Processing for Selective Roasting". He described the basic operation involved in two-stage roasting and said that it was really a partial roast followed by a completion roast. Applications of the process included the roasting of gold, pyrites and pyrrhotites, copper concentrates, zinc (more speculative). Other variations were possible where the first stage was held at temperature and the solids reacted with special gases, the treated solids then being given a finishing treatment in the second stage.

In respect of the roasting of pyrite and pyrrhotite Mr. MacAskill said that in many countries roasting plant calcine was used as feed to steel mills, but to a lesser degree in the U.S. Frequently, the calcines contained copper, lead, zinc and arsenic which were considered obnoxious by ferrous metallurgists. A FluoSolid sulphating roast had been used in Japan to solubilize the copper and to a lesser extent the zinc constituents. A two-stage roast may well fit this problem: the primary stage removing arsenic and some lead and the second stage solubilizing the copper and zinc. A plant was now being built for arsenic removal. Because of the temperature control with FluoSolids units and the temperature limits imposed by the fusion points encountered in pyrite roasting it did not appear practical at present to remove zinc by volatilization.

A conventional FluoSolids two-stage roast showed promise for use in the treatment of arsenic bearing copper concentrates.

## Machinery and Equipment

# Inclination and Direction of Drill-holes

For quickly and accurately determining the inclination and direction of drill-holes, a new survey instrument, known as the Craelius Electro-magnetic Dip Indicator, which can be used also in magnetic surroundings, has been developed by the Swedish Diamond Rock Drilling Co.

Basically, the new instrument is a pendulum, free to move in one plane, which has been called the "orientation plane". The pendulum, actuated by means of an electro-magnet, is part of an electrical circuit which includes a galvanometer, the whole being part of a signal circuit registering at the surface the pendulum reaction in the drill-hole. The strength of the current through the electro-magnet compensates the effect of gravity which the variations in the inclination of the instrument have brought about. Thus, by measuring the strength of the current through the electro-magnet the inclination of the instrument can be determined.

The indicator, which is 24.8 mm. (—1 in.) in dia. is placed in a 34 mm. (about 1½ in.) casing, equipped with a coupling orientated in the plane of movement of the pendulum. It is lowered into the drill-hole by means of rods, which are generally 6 m. (about 19 ft. 8 in.) long. By using special rod couplings having 3-pole contacts and with insulated conductors inside the rods, a continuous 3-conductor connection can be formed and orientated mechanically and electrically in a certain direction. Thus the "orientation plane" can be transmitted through the rods to a diopter head with a dial divided into degrees, from which the direction of the axis of orientation can be read off.

Using this system it is possible to determine the orientation plane of the instrument at successive points in relation to some direction or point on the surface. It is possible to measure any

angle of inclination and to determine its orientation for any angle greater than 5 deg. from the horizontal with only one Craelius instrument. The indicator is designed to be used down to a maximum depth of about 900 m. (3,000 ft.).

To determine the dip of a drill-hole, the indicator is positioned at the desired depth by means of the rods and the electrical connections established. With the diopter set in the selected O-direction, which is read off the dial and recorded, the "orientation plane" is established. Current is sent through the electro-magnet circuit and the strength of it is read on the milliamperemeter the moment the galvanometer reacts indicating that the effect of gravity has been compensated.

The Craelius indicator is then turned say 30 deg. and the angle observed on the diopter dial, the procedure repeated with the milliamperemeter readings and the operation continued with further turns of 30 deg. until a full circle has been completed. By plotting the readings graphically, a substantially sine-shaped curve is obtained from which the direction of the orientation plane can be shown in relation to the zero direction. The amplitude of the curve indicates the dip or inclination of the indicator by the strength of the current necessary to counteract the influence of gravity. As these values can be pre-determined for each dip-angle by the use of a "calibration stand" and plotted in the form of a calibration diagram, it is possible to read off immediately both the dip and the direction of the drill-hole at the point where the dip indicator is positioned.

In practice it has been found that directional determinations at about 300 m. (1,000 ft.) depth on repeated surveys coincide within 2 deg. and that the dip

determinations are made with an accuracy of  $\pm 0.1$  deg.

In deep and very curved drill-holes where friction against the walls causes a certain torsion in the string of rods as it is turned around, this torsion must be determined by taking two series of observations at each location, one while the string of rods is being rotated clockwise and the other while the string is being rotated counter-clockwise. When these two observation curves are plotted graphically they are separated by a certain angle due to the torsion in the rod string. The true direction of the plane of orientation is then the bisectrice of the angle between the two observed directions.

To obtain a three-dimensional picture of a drill-hole the hole co-ordinates can be calculated.

Drill-holes can be fully surveyed at any point over the entire hole from top to bottom without withdrawing the instrument, all the readings being made at the surface. Both dip and direction can be determined instantaneously and with observations at 30 m. (100 ft.) intervals, it is claimed that a full survey of a 300 m. (1,000 ft.) hole can be made in less than eight hours. The Craelius method can be used in drill-holes with a minimum dia. of only 36 mm.

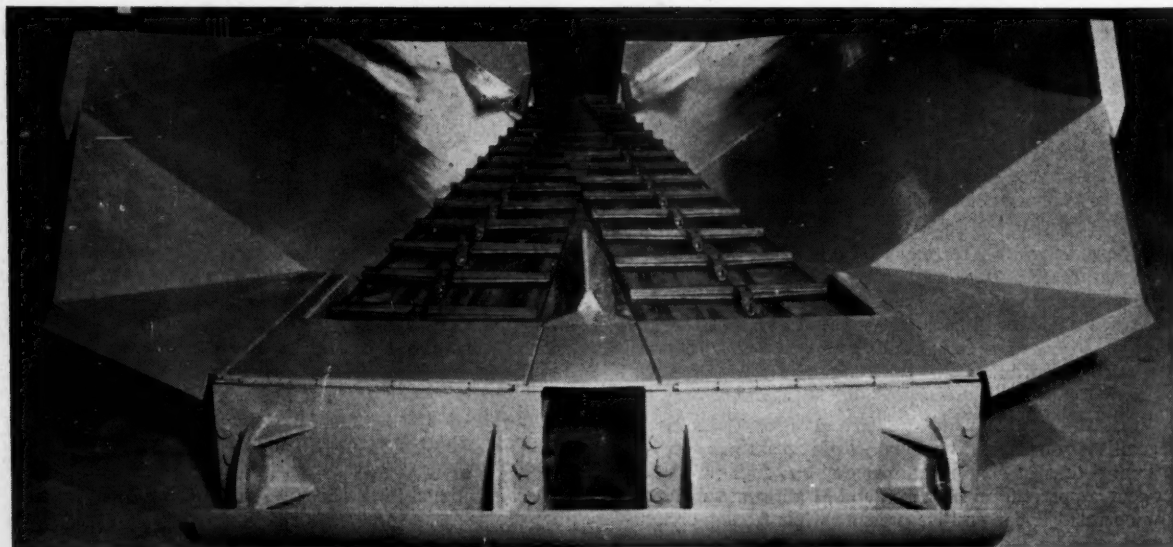
During the past five years many drill-holes are reported to have been measured by this method in Scandinavia, both for the purpose of directional drilling and general dip and deviation surveys.

## A CORE FEEDER

The CF-2 feeder made by Columbus McKinnon Chain Corp., United States, is 23 ft. long, 30 in. wide at the throat or discharge end of the feeder, 8 ft. 6 in. wide at the shuttle car loading end. The height at the discharge and loading end is 32 and 27 in. respectively. The unit weighs 5,500 lb.

The feeder is powered by a 10 h.p. motor, and the motor is connected through a V-belt drive arrangement to a shaft mounted Dodge speed reducer and the output shaft is connected to head

The Ratio-Feeder



sprocket for driving the chain. Chain speeds on this unit can be varied from 70 to 90 ft. per min. This can be done electrically through rheostat adjustment and further changes can be made by changing the V-belt pulley arrangement.

### NEW COLLIERY WINDERS

The changeover from steam to electric winders at Nos. 1 and 2 shafts of Silverhill Colliery (East Midlands Division, No. 4 Area, N.C.B.), represents a further step by the National Coal Board in its programme of reconstruction and modernization. The electrical parts for the new winders have been supplied by the A.E.I. Heavy Plant Division, as main contractors.

In No. 1 shaft, a d.c. geared drum winder has been installed in a new winder house erected on the opposite side of the shaft to the original building. The winder drum, supporting two cages in balance, is of the single cylindrical type, 18 ft. dia. by 8 ft. wide, with a maximum speed of 30.25 r.p.m. Its 800-volt d.c. driving motor is rated at 1,500-h.p., 300 r.p.m. Used mainly for coal winding, the double-deck cages run at 28.5 ft./sec. and deck consecutively, the two mine cars carrying a total net load of seven tons. An hourly output of 308 tons is drawn from the 1,235 ft. deep shaft, giving a cyclic time of 81.8 seconds.

The new winder in No. 1 shaft is at present working on manual control, but this method will shortly be made interchangeable with a pit top controlled pushbutton automatic system. Also controlled from this position is an automatic mine car handling circuit, installed by the N.C.B. a year before the winder.

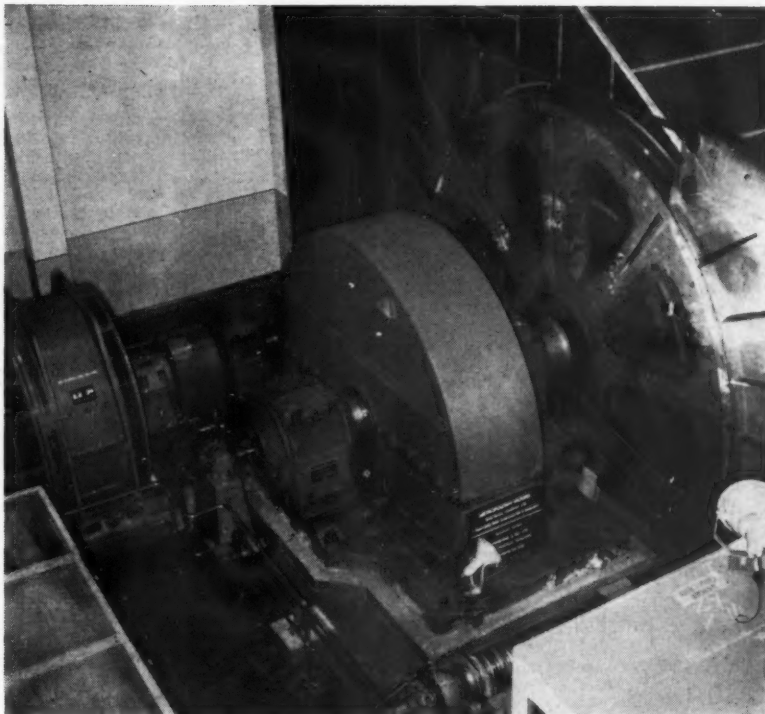
The mechanical parts of the winder were sub-contracted to Markham and Co. Ltd., of Chesterfield. The anchored post type brakes are operated by means of two service pneumatic brake engines of the quick-acting short-stroke type. In addition, two dead-weight safety brake engines are included. Each set of brake posts, brake gear, service and safety engines are entirely independent of the other set. Coal winding with the new control scheme began some months ago, and it is estimated that an annual output in the region of 700,000 tons will be achieved by 1962.

In No. 2 shaft, the winder is still steam driven, but it is shortly to be replaced by a new electric winder driven by a 200-h.p. a.c. motor. This equipment will wind men and materials.

### CANADIAN ORDER FOR IPSWICH FIRM

A Canadian dollar-earning contract worth \$1,500,000 has been won in the face of fierce American competition by Ransomes and Rapier Ltd., who have received an order from Calgary Power Ltd., Alberta, for a large electrically driven walking dragline. This new machine, one of a range recently designed specially for opencast mining operations, is known as the Rapier W1350, weighs 1,400 tons and will be equipped with a 33 cu. yd. bucket, capable of carrying 50 tons of material at a time, at a radius of 215 ft.

It is expected to be in operation by the middle of 1962 and will be used for removing overburden on top of 750,000 tons of coal required each year for power stations in the vicinity.



The A.E.I. Winder at Silverhill Colliery

### Equipment Digest

According to Sturtevant Mill Co., the largest fluid energy mill ever manufactured was completed recently at their Dorchester, Mass. (U.S.A.) plant. The mill is a 42 in. dia. micronizer and has an output of 750 lb. to 6,000 lb. per hr. Earlier in the year this firm announced that they had produced a new fluid energy mill for abrasive substances which possessed a tungsten carbide liner.

A new design of screen deck has been introduced by Allis Chalmers Mfg. Co., for moist, sticky ores. This surface, which was developed specifically for certain iron ores, comprises a series of free, loosely rolling rods which rotate and are fixed at right angles to the material flow.

Being fixed in this manner allows them to rotate in a direction opposite to the rotation of the vibrating mechanism at some 60 to 100 r.p.m., depending on throw and speed of screen. The rods have specially induction hardened ends to resist wear and abrasion.

Every mill operator knows how serious the replacement of chute linings can be, when abrasive material is being handled and dead loads are often carried in bin to prevent such wear since any movement is then between particles of ore.

This idea has been extended to chute linings by B. F. Goodrich in their new "Rifflestrip" lining, and consists of L-shaped strips of gum rubber which are fastened to the chute bottom in such a

way that they form a continuous covering but provide a series of ridges at right angle to the flow of the material. When in use material fills the grooves between the ridges formed by the series of L sections so that the majority of the wear is taken by the filling.

It is claimed that the system will outwear conventional plain rubber linings and that it is also possible to employ the strips in hoppers, and on launders.

A motorized wheel designed to give large earth movers unmatched versatility has been designed by General Electric Co., United States. The company declares that the wheel gives the highest horsepower utilization throughout the vehicle speed range of any available drive as well as making possible more maintenance-free working days per job.

The drive, designed for large off-highway vehicles, eliminates transmissions, axles and gear shifts by including the electric traction motor as an integral load-carrying part of the wheel. Because motorized wheels can provide all-wheel drive from a single engine supplying electric power through a d.c. generator, multiple engine arrangements are unnecessary. Braking is accomplished under the dynamic braking concept, meaning the energy of the vehicle's motion is converted into electrical energy by the traction motors acting as generators. The electrical energy is dissipated as heat to stop the vehicle. Stopping in three vehicle lengths at 35 m.p.h. is claimed as possible.

# MINING MISCELLANY

The Russian Government has granted the French company Etablissements Préparation Industrielle des Combustibles an order for five coal preparation and processing plants. This firm works in co-operation with Krupps.

A report issued from Hanoi, capital of North Vietnam, via Hong Kong stated that mineral production has played a considerable part in raising the past year's total production figure by 77 per cent. The North Vietnamese Government reports that output of coal, iron, copper and zinc is progressing well, and is above pre-war levels, while an important large-capacity steel works is being built at Thai Nguyen. Working with indigenous raw mineral materials, North Vietnam plans to build up a synthetic fertiliser industry which will make the country completely independent of imports in this field.

It is announced from Warsaw that the Polish Government is to invest 360,000,000 zloty in the mineral mining industry next year, out of a total annual investment of 2,200,000,000 zloty. This investment budget is lower than that previously planned for 1960, and is a recommendation from the national investment bank, but it is generally anticipated that the bank's ruling will be adhered to by ceiling authorities in the country.

Wages of employees in the iron ore industry of Lower Saxony, where almost all West German iron ore is located, have received a pay increase of 4 per cent. The oreworkers' union had asked for 6 per cent.

It was decided recently at a general meeting of Pechiney, the French metallurgical and chemical producer, that this company should buy up Penarroya's shares in the Argentine non-ferrous metals company, Elaboracion General del Plomo. Penarroya will receive Pechiney shares to the value of French Frs.362,500,000 in return for the holding. This take-over is connected with the fact that almost 93 per cent of the Elaboracion capital is tied up in a holding in the Argentine metals preparation concern, C.A.M.E.A., which operates aluminium and copper rolling and pressing mills. At the same time it was announced that Pechiney was to raise its own capital by Frs.175,000,000, to take over the chemicals-from-rare-earths company, Société des Produits Chimiques des Terres Rares, and raise its capital by Frs.528,640,000. They are also to take over Société des Produits Chimiques de Ribécourt.

The West German mineral exploration concern, Deutsche Schachtbau- und Tiefbohr G.m.b.H., which has been working together with the French North African company, Entreprise de Forages Nord-Africaine S.A.R.L. in the search for minerals in the Algerian Sahara, has announced that the companies are now to form a joint subsidiary for this work under the name EFNA-Deutsche Schachtbau, S.A. The new company gives as its objective "the boring for mineral oil, natural gas, minerals

and water in Algeria, as well as in Metropolitan France and other members of the French Union". Share capital of the company, which is registered in Algiers, is French Frs.482,000,000, the majority of which is held by the German concern.

The North Korean authorities have announced the names and addresses of foreign trade organizations which are to be responsible for their imports and exports. They include Machinimport, Pyongyang City, responsible for all ferrous and non-ferrous metals and metallic products and machinery, and the ceiling foreign trade organization, Export and Import Company of the People's Republic of Korea, also of Pyongyang City, to which all other enquiries should be sent for forwarding to the relevant department.

Under the law establishing the Mexican National Atomic Energy Commission, uranium deposits recently discovered in Chihuahua State were included in the national mineral reserves. One of these deposits, with an area of 1,700 hectares, is located in the northern part of the Mesquite mountains in the municipality of Ojinaga—the other is in the northern part of the Gomez mountains, in the municipality of Aldama, and covers an area of 1,734 hectares.

Prospectors working in the Nyirad basin in Hungary claim to have discovered the biggest bauxite deposit so far found in that region. The layer, situated at a depth of some 70 m., contains several million tonnes of bauxite, and in many places the ore layer is reported to be 20 m. thick. Detailed surveying of the deposit has begun.

Three new coal mines now under construction in the Donetz Basin are to produce 10,000 tonnes of coking coal per day, according to a Soviet announcement. Hydro-monitor operation on 100 p.s.i. water pressure is to cut the coal from the seam. In this operation coal, water and rock are funnelled through special grooves to the shaft whence high-output pumps get the material to the surface.

It is reported from Israel that the Timna copper plant in the Southern Negev has finished running-in operations and has reached the 7,000-ton annual output capacity planned. This level was actually reached in September last, and further investment is planned to increase production by another 10 to 20 per cent. The main 200 m. long subterranean tunnel has been opened, and the boring of side branches is under way. These will be utilized when the upper strip mine, now being worked, is exhausted, which is expected in about two years. The exports of this mine will be mainly directed to Japan, Brazil, Western Germany, Portugal and the United Kingdom during 1960. A further project is the opening of a mining school for the training of foreman and skilled miners.

It is officially announced from Kitwe, that talks on African advancement of the Copperbelt will begin next month in

Northern Rhodesia. The discussions will be held at the next meeting of the Mining Joint Industrial Council between the mining companies and the European Mineworkers' Union, and the Council states that these will at first be of an exploratory nature.

A new railway route to northern Quebec was officially opened this week. The route marks the completion of a 331-mile belt line, linking points in Quebec and Ontario, with a 30,000 sq. mile area rich in deposits of copper, gold, zinc, nickel, iron ore and timber. The new line will bring Chibougamau 200 miles closer to Montreal, give easy access to deep water ports on the Saguenay River, and generally should give impetus to northern development.

The export market figures prominently in the plans of Premium Iron Ores at Lakehead, Ontario, who are to produce iron by a new direct-reduction process. Recent market surveys indicate that 80 per cent of the entire output would go to U.S. steel furnaces. The rest would be marketed in Western Canada. At first, ore would come only from Ontario's Steep Rock Iron Mines. This would supplement Steep Rock's present operations. Premium does not plan to produce steel at the Lakehead plant. Pig iron would be the end product.

Officials of Northern Ontario Natural Gas Co. Ltd., have announced a new natural-gas contract for 1,000,000 cu. ft. per day to serve the Canadian Johns-Manville Co.'s Munro mine. Located near Matheson, the mine operations include drying the ore and extracting the asbestos fibre. The gas will be used for plant heating, mine-air heating and drying asbestos ore.

South Africa will shortly start exporting anthracite to South America. A consignment of 50,000 tons of duff is to be shipped to the new San Nicolas power station near Buenos Aires.

It is claimed that uranium deposits of high radio-activity have been discovered in the Province of Salta, Argentina, and technical experts from the Atomic Energy Commission are now carrying out extensive field investigations.

The director of the Bor mine, the biggest copper producer in Yugoslavia, announces the discovery of new copper ore deposits reported to be extremely large. It is claimed that the deposits would enable raw copper production at the Bor mine to be raised from the current 30,000 tons to 125,000 tons over the next 20 years. The mine and a nearby smelting plant and fertiliser factory are being developed with the help of \$40,000,000 invested by French and Belgian interests. Most of the copper now produced is exported to the U.S.

Mr. John G. Welles of the Denver Research Institute, stated at the recent Western Resources Conference in Boulder, Colo., that the shale oil deposits of Colorado could become a profitable industry by 1965, or even

earlier. It was also forecast that the Western U.S. coal industry should be making a comeback about this time.

A bill, authorizing a \$2,000,000 start on a new research programme aimed at developing new uses for coal won approval in the U.S. Senate recently. The measure calls for the creation of a new agency, the Coal Research and Development Commission, to handle the programme. The bill, as passed by the Senate, would set up a three-member coal commission appointed by the President as a largely independent agency.

The Government of the Union of South Africa is to investigate large deposits of low-grade coal in the Eastern Cape Province in the hope that it can be used to provide electricity for the whole of the Border area. The Minister of Bantu Administration Mr. de Wet Nel, told a deputation at Indwe that the Government Mining Engineer would be instructed to carry out the investigation. The coal is low-grade and of the Stormberg series, but there is plentiful labour and water. It was suggested that electricity should be generated at the pit's mouth for the electrification of the Eastern railway system, and that cost of production would be the cheapest in the world, as most of the deposits were on Crown land and no royalties would have to be paid. It was also suggested that industries to produce tar and petrol might be established.

Representatives from three western Canadian coal companies are shortly to meet in Tokyo with representatives of the Japanese steel industry with a view to selling them more coal during the next three years. This will be their first direct meeting, as previous negotiations have been conducted between trade officials. The three companies are currently delivering 110,000 tons of coking coal to Japan.

Problems of increasing the resources of metallurgical raw materials, fuel and scrap metal, and the output of iron and steel were discussed at a recent meeting in Moscow of the Russian Economic Mutual Assistance Council's permanent commission for economic, scientific and technical co-operation in ferrous metallurgy. Member countries of the Council agreed upon recommendations for considerable expansion in ferrous metals.

The value of mineral production in Northern Rhodesia for the first eight months of this year has already exceeded the total for the whole of 1958. Values for the first eight months of 1959 now aggregate £85,116,040 compared with £55,267,582 for the corresponding period last year, and with £77,262,866 for the whole of 1958.

The Finnish Government copper mining corporation, Outokumpu Oy, will start exploitation of its new nickel mine at Kotalahati at the beginning of 1960. Ore output in the first year will amount to some 300,000 tons, and will be enriched on the spot and taken to the nickel smelter at Harjavalta. It is expected that the deposit will last for 10 years, and will meet Finland's requirements for nickel.

The Tasmanian Premier, Mr. Eric Reece, announced this week that negotiations between the Tasmanian Government and the Broken Hill Pty. Co.

Ltd., had resulted in a decision to establish an electro-metallurgical industry at Bell Bay on the Tamar River. Mr. Reece said a 280-acre site would adjoin the plant of the Australian Aluminium Production Commission at Bell Bay. At first the new factory would produce ferro-manganese for steel making. Capital outlay for the first stage would be about £A1,660,000. The plant would mean an immediate saving in overseas exchange of £A1,500,000 a year and would ensure supplies of alloys essential to the Australian steel industry. A new company, Tasmanian Electro Metallurgical Co. (Pty.) Ltd., would operate the industry.

At a meeting held recently in Prague of the Czechoslovak East-German Council for Economic Co-operation, agreement was reached on extensive mutual aid in relation to the development of the potassium industry in East Germany. Czechoslovakia will provide East Germany with machinery and equipment required for that development, to the value of 110,000,000 roubles, and will receive, in return, increased exports of potassium fertiliser required for the development of increased output of her agriculture.

A four-year development effort at the Silver Mountain project, east of Mullan, Idaho, has been discontinued after an expenditure of nearly \$1,500,000, and workmen have started removing the mining equipment. The object of the project, a joint venture by the Hecla Mining Co. and the Bunker Hill Co., was to probe beneath the old Snowstorm copper mine, but extensive drilling failed to find any mineralization.

The Mississippi River is now being used to transport barge shipments of foreign iron ore to the steel mills of Chicago and St. Louis. The departure point is Burnside (La.), 30 miles beyond Baton Rouge, which is owned by the Greater Baton Rouge Port Commission and serves as a transshipment point for imported ores, which are brought to Burnside by ocean-going ships. Before the steel strike began about 20,000 tons of iron ore a week passed through Burnside terminal, and the tonnage is expected to increase sharply after the strike is settled.

Mr. Francis Piquette, of the Piquette Mining Co., a zinc mining and milling concern announced that the Piquette mine in Tennyson, Wisconsin, jointly-owned by the Piquette Mining Co. and the American Zinc, Lead and Smelting Co., has been re-opened because of the higher price of zinc. The mine has been closed since December, 1957. American Zinc, Lead and Smelting Co., recently announced the re-opening of other mines in Southern Wisconsin for the same reason.

It is reported from Belgrade that Yugoslavia will buy a minimum of 60,000 ton of crude phosphates and about 3,000 tons of manganese ore annually from the United Arab Republic.

## PERSONAL

The geological and mining consultancy firm of Mackay and Schnellmann announce the following movements of members of their organization connected with professional visits of short duration:

Dr. G. A. Schnellmann has left for Portugal; Mr. H. F. Burton is temporarily leaving Iran and returning to the U.K., after which he will be going to Burma; Mr. D. J. Simmons has returned from West Asia and will shortly be going to South America; Mr. W. G. Yuill has left for Spain.

Mr. George Archibald Williamson has resigned as chairman and director of Meru Tin Ltd., on account of advancing age. Mr. Samuel Leslie Potter, who has been a director of the company since November, 1950, has been appointed chairman in his stead.

Mr. J. W. Meredith, managing director of Huntingdon, Heberlein and Co. Ltd. (a subsidiary of Simon-Carves Ltd.) has been appointed a director of Simon-Carves Ltd.

Mr. J. T. Chadwick, F.C.A., has resigned from the Board of Beralt Tin and Wolfram, Ltd.

## R.S.M. ASSOCIATION DINNER

The 75th Annual Dinner of the Royal School of Mines Association was held at the Apothecaries' Hall, London, E.C.2, on Tuesday of this week under the chairmanship of Mr. Frank Higham, President of the Association. In responding to the toast of the Association, proposed by Mr. N. G. Annan, Provost of King's College, Cambridge, the President commented on the notable improvement over recent years in both the quality and quantity of new entrants to the Royal School of Mines. The entrants of today might not have the inherited tradition of mining characteristic of many pre-war entrants, but the basic human material was if anything better than before the war.

In responding to the toast of the Guests, which was proposed by Mr. W. A. Hardy, Mr. J. N. V. Duncan, Managing Director of Rio Tinto, was at pains to emphasize the future personnel needs of the mining industry in a world where rapidly expanding populations in the economically less advanced countries were bound to place sharply rising demands on mineral production. It was not enough in Mr. Duncan's view that boys should be forthcoming from secondary schools in sufficient numbers. It was of even greater importance that those attracted into the British overseas mining industry should be of a quality which would enable them to measure up to the physical and intellectual demands which mining imposed upon its managerial staff.

Guests of honour in addition to Mr. Annan and Mr. Duncan included Professor J. C. Mitcheson, Dean of the Royal School of Mines; Dr. C. D. Black-Hawkins, Headmaster of University College School; Mr. M. M. Milligan, Warden of Radley College; Mr. J. M. Corin, Secretary of Imperial College; Mr. B. W. Kerrigan, Secretary of the Institution of Mining and Metallurgy; Dr. L. A. Jordan, C.B.E., President, R.C.S. Association; Mr. J. D. Peattie, C.B.E., President, Old Centralians; Mr. J. W. Voelcker, Hon. Secretary of the City and Guilds Institute; Mr. A. M. Holbein, C.B.E., Hon. Secretary, Old Centralians; Mr. W. L. Hewitt, Hon. Secretary, R.C.S. Association; Mr. M. J. Callow, President, R.S.M. Union and Mr. A. Ewart, Hon. Secretary of the R.S.M. Union.

## Metals and Minerals

# Wolfram Market More Soundly Based

The improved outlook for wolfram producers was discussed by Mr. F. Gates, chairman of Beralt Tin and Wolfram Ltd., in his address to shareholders at the annual meeting on November 3. The market price for wolfram, he pointed out, can rarely have been subject to such violent fluctuations as during the last decade. From 90s. per unit at the beginning of 1950 it rose very sharply as a result of the Korean crisis to a peak of 675s. in March, 1951. It then fell, abruptly at times, to 102s. in March, 1954, but recovered to 272s. 6d. in March, 1956. From that level it drifted downwards almost without interruption, reaching 162s. at the end of March, 1957, and 92s. 6d. at the end of March, 1958.

Demand from consumers was very low during 1958. According to surveys issued by the U.S. Bureau of Mines, consumption of tungsten during that year was only about 5,500,000 lb. (the equivalent of less than 5,000 tons of concentrates of normal grade) as compared with a yearly average of about 9,000,000 lb. during the two preceding years. Moreover, substantial stocks of wolfram, which had accumulated in various hands in the course of the price recession, were available to satisfy a great part of the limited demand. In these circumstances the wolfram price continued to fall until, at the end of September, 1958, it was as low as 62s. 6d. per unit.

The past year was thus a difficult one for all producers of wolfram. Many wolfram mines all over the world, which had been brought into production as a result of the high prices ruling during the Korean crisis, were compelled to close down. In the U.S., for example, where over 700 mines were producing tungsten ore in 1955, only two of these mines were working at the end of 1958, and in one of these tungsten ore was only a by-product. In the circumstances, it says much for Beralt's stability that it proved possible during this difficult period to continue operations without cutting down the company's technical staff in Portugal.

The curtailment of production throughout the world and the gradual consumption of accumulated stocks have recently led to firmer conditions in the wolfram market. The price rose to 95s. per unit at the end of November, 1958, and fluctuated between limits of 80s. and 105s. until September this year, when a sudden flurry—indicating that there was not much wolfram available for prompt delivery apart from government stocks—drove it from 100s. to 160s. in the course of a fortnight. This sudden price increase enabled Beralt to dispose at a satisfactory price of a considerable part of the wolfram stocks it had for some time been holding. Some months previously, in anticipation of firmer market conditions, the board had given instructions for the company's production of wolfram to be gradually increased, and monthly output is now running at about 170 tons.

For the time being, prospects certainly look brighter, but maintenance of this improvement must obviously depend on the price of wolfram remaining at a satis-

factory level. Mr. Gates doubts whether the price level is yet high or steady enough to encourage resumption of productive operations at many of the mines which have had to close down during recent years. He hopes, however, provided the market is not further unsettled by too hasty realizations of government stocks, the price may be maintained at a level which would allow the company to make profits which will show a reasonable return on its capital.

Beralt's reserves of wolfram ore are described as sufficient to meet any probable demand. Not only are there still ample reserves on the east side of the Main Fault between Main Adit Level and Level 2, which is over 500 ft. lower, but further development of the extensive system of wolfram veins of good grade encountered west of that fault, both above and below Main Adit Level, has yielded good results, and current production of wolfram is coming almost entirely from this area. Besides its large ore reserves, the company has a well equipped mill from which wolfram concentrates of high grade can be produced at a comparatively low cost per unit.

Mr. Gates expressed the opinion that, apart from government stocks, the underlying basis of the wolfram market was sounder now than it was two years ago, when much larger commercial stocks were overhanging the market.

## U.S. ALUMINIUM OUTLOOK CHANGES

A number of setbacks over recent weeks, both within and without the industry, have led to considerable revision in the short-term outlook for U.S. aluminium producers and in the estimates of production, both for the remainder of 1959 and for the year as a whole. These setbacks include the long duration of the steel strike with its effect on direct and indirect aluminium demand, delayed settlement of the industry's own labour problems, and the rising trend in imports from other countries. A few weeks ago it looked as if the 1959 output would run as high as 1,950,000 tons. Present indications are that it will fall short of this estimate.

Reynolds Metal has cut its primary aluminium operating rate to 80 per cent of capacity from 100 per cent early in the summer, and 91 per cent at the end of October. Kaiser recently announced that it was cutting operations to 80 per cent of capacity from the current 90 per cent. Alcoa's operating rate, having been held at 82 per cent of capacity for about six months, is described as being under less pressure.

Fears that the long strikes in steel and copper would spread to aluminium have been reduced by the indefinite extension of the contracts between the United Steelworkers and the "big three"—Alcoa, Kaiser and Reynolds Metals. Nevertheless the delay in finalising new contracts leaves most of the industry in the dark as to the actual cost of current production.

Meanwhile Kaiser has completed a major expansion of super purity production facilities at its Mead reduction plant, increasing production capacity for the metal three-fold to over 500 s.tons annually. Super-purity aluminium entails refining metal under carefully controlled conditions, with the purity of the metal guaranteed at better than 99.99 per cent.

In the United Kingdom the outlook for aluminium consumption continues to improve and the demand for Canadian metal has been further stimulated by the falling off in supplies of East European material and the dwindling of offerings from Western Europe. The latter development is largely the result of the drought, which has brought about a shortage of hydro-electric power in certain producing areas (notably Scandinavia and part of France and Italy).

The Swiss engineering firm Escher Wyss AG of Zurich has received an order for six water turbines from Alcoa, each capable of generating 46,700 h.p. These turbines will be used for Alcoa's power station in Dutch Guiana to supply the company's projected aluminium works which will produce 60,000 tons of metal annually.

The world's largest self-unloading bauxite carrier, the *S.S. Richard*, recently completed its 100th trip to the Reynolds alumina plant near Corpus Christi, Texas, averaging 31,000 tons on each voyage. With a capacity of 32,400 tons, she is one of three self-unloading ships built for transportation of bauxite from Haiti and Jamaica.

## LARGE MOLYBDENUM FIND

A molybdenum deposit, claimed to be second in world importance to that at Climax, Colorado, U.S.A., has recently been discovered by the firm of Mazzacurati and Giacomelli, of Rome. Situated between the two towns of Ala Dei Sardi and Buddoso in Sardinia, the deposit is reported to extend over 7,000,000 sq. ms. According to a provisional estimate, the molybdenum content is in the region of 5,000,000 tons. The percentage of molybdenum in the rock is given as 0.6. First estimates place the cost of the extracted molybdenum at around \$1.25 per lb. The company has applied for a grant to build two dams on the Pannunzu River to contain the waters necessary to feed a pilot plant, as well as a commercial plant for the enrichment of the crude ore.

## THORIUM IN THE U.K.

Rio Tinto and Dow Chemie A.G., the Swiss subsidiary of Dow Chemical Co., have jointly acquired the share capital of Thorium Ltd. from Imperial Chemical Industries and Howards and Sons of Ilford.

Thorium Ltd. is the U.K.'s major producer of thorium oxides and salts, which are used in a range of general industrial applications, particularly in the manufacture of incandescent mantles and in alloying. The company also produces cerium compounds for use in optical polishing powders and in the cores of arc carbons. A variety of rare earth compounds is also produced. Thorium Ltd. has previously produced material for the atomic energy field, but at present the output of compounds for nuclear use is described as very small indeed.

### NEW GOLD MARKETING COMPANY

Indicative of the continued expansion of the bullion trade is the news that the Toronto Gold Marketing Co. has been formed in Toronto for the purpose of selling gold as a commodity. Gold will be sold in any quantity, the minimum being a bar of 10 troy oz. It will be stored in the vaults of the Guaranty Trust Co. of Canada, Toronto, which will act as custodian for the owners. Delivery will be made on surrender of the warehouse receipt issued by the Guaranty Trust Co.

### INDIAN MANGANESE REGULATIONS

The Government of India has announced the procedure for regulating exports of manganese ore during the period September 1959/October 1960. A trade note issued by the Joint Chief Controller of Exports states that the last date for receipt of applications has been fixed as November 5, 1959. Established shippers, mine-owner-exporters and the State Trading Corporation will be given an allotment of quota for a quantity equal to the quota issued to them in 1957-58.

### NICKEL-CUPRIFEROUS ORES

A new process for treating nickel-copper and ferrous concentrates to produce sulphuric acid and pig iron, to be used by the New Manitoba Mining and Smelting Co., is expected to attract industries to Canada and mid-western United States. A plant now being constructed in Greater Winnipeg is being financed by

Canadian and U.S. interests and is geared to produce sulphuric acid for \$38 a ton, as against \$50 a ton now being paid. Near it will be built a \$1,400,000 plant to produce pig iron which, it is estimated, will sell at about \$50 a ton. These two plants, it is claimed, will enable the whole of the concentrate output—sulphuric acid, nickel and copper—to be separated and marketed at costs which previously were not economical.

### JAPANESE QUICKSILVER INVESTMENTS

A Japanese concern, Nomura Mining Co. Ltd., is reported to be planning to make an investment in a development project at a Mexican quicksilver mine. The company is said to be interested in obtaining a permanent supply of raw material for the metal. The proposed investment would be made through a link-up with Associated Metals and Minerals Corporation, New York (represented by Asoma Corporation as the sole agent in Japan). One of Nomura's geological experts is now visiting Mexico to make a preliminary survey of quicksilver in resources in that country.

### U.K. MAGNESIUM PRICES

A split price has for the moment developed in British Magnesium ingot quotations as a result of Alcan (U.K.) Ltd., having announced, with effect from November 5, a reduction of 3d. per lb., bringing their quotation to 2s. per lb. delivered customers' works for ingot of 99.8 per cent purity. No change is reported in the quotation from Magnesium Elektron Ltd., which remains at 2s. 3d.

### TIN STEADY—SMALL BUFFER SALES

The tin market has again been maintained at a steady quotation and it is believed that the buffer stock has made further small sales. The contango has been maintained although stocks fell by 179 tons to a total of 7,671 tons. Shipments of tin from Malaya during October totalled 5,193 tons, all of which were shipped from Penang with the exception of 8 tons: this figure shows a considerable advance on the total of 3,288 tons shipped in September and indicates that shipments against the increased export quota took place very quickly.

The only other news of interest has been a report that Malaya has asked for the present International Tin Buffer Stock to be liquidated by June, 1961, and that a completely new buffer stock should be built up under any new agreement coming into effect after that date. It would appear that this attitude is dictated by domestic considerations as such an action would enable a repayment to be made on the contributions levied under the existing agreement.

On Thursday the Eastern price was equivalent to £807 per ton c.i.f. Europe.

### LEAD/ZINC OUTPUT RESTRICTION TO BE REVIEWED?

The quotations for lead show an appreciable advance and this seems due to the fact that supplies are not as plentiful as they were. Demand continues at a satisfactory rate. The same position exists in the zinc market although there has been a slight reaction after the sharp rise which has taken place during the past weeks. In America, however, demand is being affected by the steel strike and the attempt to raise the zinc quotation has failed and all suppliers are now quoting 12½ c. per lb.

The strength of the lead market has given rise to renewed speculation as to whether any meeting will now be called to review the voluntary restriction in availability of the two metals agreed on by the major producers earlier in the year but, as has been pointed out before, this is an extremely difficult question as the present position is that if sufficient zinc is produced then automatically too much lead will become available but this is a problem which will have to be faced and probably the sooner the better.

Closing prices are as follows:

	Oct. 29		Nov. 5	
	Buyers Sellers		Buyers Sellers	
<b>COPPER</b>				
Cash ..	£254	£255	£259	£260
Three months ..	£241	£242	£247½	£248
Settlement ..		£255		£260
Week's turnover	17,225 tons		9,950 tons	
<b>LEAD</b>				
Current ½ month	£70	£70½	£74½	£74½
Three months ..	£71	£71½	£74	£74½
Week's turnover	6,875 tons		8,950 tons	
<b>TIN</b>				
Cash ..	£793½	£794½	£793½	£794
Three months ..	£795	£796	£797	£797½
Settlement ..		£794½		£794
Week's turnover	565 tons		910 tons	
<b>ZINC</b>				
Current ½ month	£96	£96½	£93½	£93½
Three months ..	£91½	£91½	£89½	£90
Week's turnover	6,745 tons		5,000 tons	

London Metal and Ore Prices appear on inside back cover.

## COPPER • TIN • LEAD • ZINC

(From Our London Metal Exchange Correspondent)

After many months of being the Cinderella of metals it has been lead which has made the best showing during last week with an appreciable rise in the price and elimination of the contango, whilst the three other metals showed little movement. The background to all four, however, remains the same, namely one in which the slowly increasing effects of the U.S. steel strike are contending with a reduction in the availability of metals due to strikes and voluntary cut-backs and as is to be expected the former tends to have the greater influence the longer it lasts.

### STEEL SHORTAGES OFFSETTING COPPER STOPPAGES

The copper situation has altered little on balance as the settlement of the strike at the Braden mine has to a certain extent been offset by a walk-out at the White Pine Copper Co.'s mine in Michigan and an interruption in the production at Carteret owing to an explosion in one of the converters. There has also been a breath of trouble in Rhodesia where there was a very short-lived dispute with the timbermen at Mufulira, whilst in the Belgian Congo it is apparent that the racial disturbances are by no means at an end.

The demand for copper in Europe

remains good and both Russia and China have shown some buying interest in recent weeks and this, combined with avid buying by dealers in New York has continued to add strength to the copper price but, with considerable liquidation taking place on the market, the actual price movement has on some days even been in a downward direction.

In the U.S. itself dealer copper has changed hands at up to 39 c. per lb. for early December shipment with late December shipment being about 0.5 c. per lb. cheaper: there is no customs smelter quotation but U.S. producers still operating are selling at 31½ c. per lb., whilst Kennecott is still delivering a small tonnage at 30 c. per lb. The present Belgian price, after its recent move upwards, now stands at approximately 31 c. per lb. Antwerp or New York.

There is now no doubt that the U.S. steel strike is having an increasing effect upon the country's industry and all sections of the copper fabricator industry report a slackening in demand but, in spite of this, there have been a number of price rises for fabricator products. The London market, itself, has shown no outstanding features except that the backwardation has not increased in spite of a reduction in stocks in official warehouses of 1,593 tons to a total of 7,857 tons.

## Mining Finance

# Further Hoist in Harties' Capital Spending

For three years now Harties shareholders have had to face the news that an earlier estimate of future capital expenditure was going to be too low. In 1957, it was stated that the preceding year's estimate—£6,000,000 for the four years to June 1960—would be exceeded. In 1958, £8,500,000 was given as the probable total for the same period. Now, with only one year to go, Mr. Bernstein, the chairman, states that expenditure in the current financial year will total some £2,500,000, compared with the £1,500,000 remaining out of the previous estimate. This is similar to the rate at which expenditure has been running over the past three years, and hopes that Harties might be beginning to climb out of the stage of heavy appropriations have once more been dashed.

For estimated spending to rise from £6,000,000 to £9,500,000—an increase of more than 58 per cent—in the space of three years is something like a disaster, even to a mine as rich as Harties, and it is this situation, of course, which has caused the company to reach a higher yield basis—currently 10.6 per cent—than any other mine of comparable youth and richness. The reasons for the accelerated spending are several, but the most important is the doubts which surround the deeper area of Harties' lease. Although the chairman said

last year that there was then no reason to believe that the area would turn out any worse than the rest of the mine, the market has consistently refused to believe this.

It now begins to look as if the market has been proved right in its interpretation of results from the deeper area, for although there are signs that values there are on the mend, the general payability of the ore still seems to be significantly below that of the rest of the mine. Indeed, there are tacit admissions in the chairman's statement to this effect, in particular in the announcement of plans for the expansion of development in the deep area to an average of 9,000 feet per month. This should ensure that sufficient stope faces are available in the deeper area to replace depletion in the shallow area. Clearly, this means that the fall in Harties' mill grade, currently around 10.2 dwt. (1958-9 average 10.9 dwt.) is not yet over, and, indeed, that the worst may be yet to come.

Simultaneously, mill throughput is to be expanded to a nominal plant capacity of 130,000 tons per month, and it is expected that 120,000 tons will be treated next March. This will go some way to offset the fall in grade caused by the fact that by that time about 33 per cent of the mill feed will be coming from the deeper area.

Harties shareholders' other main worry at the moment is the beginning of tax liability, which cropped up for the first time last quarter in spite of the heavy capital spending. Next year's liability will be abated to some extent by the £2,500,000 of capital expenditure planned, and full incidence will continue to be deferred until the No. 4 shaft, which will be begun next year, has been commissioned. Nevertheless, it is unlucky that Harties has had to face this additional burden at such an awkward time, and this must have played some part in the decision to give consideration to raising loans to finance some of next year's spending. This may help maintain dividends in the short run, but looking further ahead it is difficult to see how a cut can be avoided, particularly in view of the expiry of the uranium contract in 1966. Although Harties cost per lb. of uranium produced is very low by South African standards—and it may be possible to push it even lower when a pressing incentive exists—a halving of the price the company is receiving now could mean a drop in revenue from this source from the present level of about £2,750,000 net per annum to about £1,850,000 in spite of the cessation of loan repayments.

Harties current quotation presupposes future dividends of about 5s.-5s. 3d. compared with the present rate of 7s. Only time will tell whether this is sufficient allowance for the difficult times ahead. Certainly in this case a 10½ per cent yield is not as generous as might be thought.

## LONDON MARKET HIGHLIGHTS

Mining share markets were generally more subdued last week. Once again, interest centred on base-metal sections, but with the exception of the tin group buyers were finding it more and more difficult to find reasonable yields still offered.

Tin shares thus continued to move ahead, although a certain amount of profit-taking set in around mid-week. Pahang, for instance, came back to 7s. 10½d. after reaching 8s. 10½d. on the higher dividend. Ayer Hitam, previously a Singapore favourite at 45s. reacted to 43s. 6d. and Petaling eased to 8s. 1½d. after 8s. 6d. Despite this, however, the undertone of the market remained as firm as ever and the few sales were eagerly taken by dealers embarrassingly short of stock. This must have particularly applied to Gopeng (17s. 4½d.) and Kinta (5s. 10½d.) which have both been strong ever since the merger was announced.

Coppers never really recovered from a dull start on Monday. This reflected fears that settlement of the El Teniente strike in Chile would cause a sharp break in the copper price. The fears were overdone because the setback in the price was not especially severe and a recovery soon set in later. Even so, profit-taking persisted in many recent favourites such as Bancroft (26s. 6d.), Rhokana (38½), Messina (127s. 6d.) and Rhodesia-Katanga (13s. 9d.). "Tanks" (51s. 3d.) were additionally depressed by the troubles in the Belgian Congo although there was no news of rioting in the area where the Union Minière mine is situated.

South African Gold shares were left out of the picture to a large extent and, as is

usual on such occasions, prices tended to drift lower. Even the appearance of another batch of record profits in the October returns failed to cheer the market. Blyvoor improved to 30s. 7½d., but peak earnings at West Driefontein and Free State Geduld left the respective share prices slightly easier at 185s. and 179s. 4½d. Hartebeest dropped 3s. 3d. to 62s. following the report with its news of higher capital spending.

Against this rather easier trend, Marievale were consistently firm and rose to 28s. 3d. Consideration of good yields allied to encouraging future prospects helped Vaal Reefs (45s. 6d.) and Doornfontein (35s.) while a Cape demand following the monthly declaration lifted Western Reefs to 31s.

Shares of the Finance Houses were generally easier, Anglo American reacting to 206s. 3d. after their recent strength. Central Mining fell to 92s. 6d. and Selection Trust at 130s. reflected the dullness of their copper interests. New Wits, however, spurred 3s. to 11s. 6d., a move which has caused speculation as to the possibility of some take-over deal.

Diamonds were remarkably firm, De Beers climbing to £10 before later reacting to 197s. 6d. "Casts" rose to 30s.; the new Sierra Leone Government Diamond Office seems to be making headway in the fight against what has been rampant diamond smuggling in the territory. Elsewhere, Kwahu were a good spot with a steady rise to 7s. on speculative buying and another West African Gold, Bibiani, hardened to 4s. 4½d.

## SOME GOLD FIELDS GROUP CHAIRMEN'S STATEMENTS

Statements by the chairmen of the June year-end companies of the Gold Fields group were published this week. Mr. J. M. M. Ewing, chairman of F. S. Saaiplaas, said that if development results during the current financial year continue to bear out expectations based on the drilling programme, the arrangements for borrowing £3,500,000 announced last July should provide sufficient capital until working profits have reached a substantial level.

The Sub Nigel chairman, Mr. J. W. A. Wright, said that although it would be possible to maintain mill tonnages till the end of the year, and possibly longer, grade would inevitably continue to decline, and with it profits available for distribution.

Mr. W. M. Barclay, chairman of Luipaards Vlei, stated that the better African labour situation during the year had facilitated exploration and reclamation work in promising areas of the mine. Although the yield of these areas is below the average for the mine, they are helping to eke out Luipaard's declining reserve tonnages.

## GOVERNMENT LOAN FOR MT. ISA RAILWAY?

A report from Canberra states that the Australian Government is prepared to lend Queensland up to £A20,000,000 towards the £A30,000,000 needed to reconstruct the Mt. Isa-Townsville railway. The reconstruction of the railway is an essential adjunct to Mt. Isa's expansion plans.

Speaking in Brisbane, Mr. G. F. R. Micklin, Premier of Queensland said that Queensland would provide the remaining £10,000,000. The project, he said, would be of incalculable value, not just to Mt. Isa and Queensland, but to the whole of Australia.

Previously, the World Bank had been asked for assistance in the project, but had turned the scheme down because Mt. Isa refused to give the traffic guarantees insisted on by the lending authorities.

#### GOLD FIELDS PAYMENT EXCEEDS FORECAST

At the time of the bids for Anglo-French, New Union and H.E. Proprietary, it was forecast by Consolidated Gold Fields that the final dividend for 1958-9 should be not less than 3s. 6d. In the event, 3s. 9d. is to be paid, making a total of 5s. for the year against 4s. 6d. last year. Profits, too, are above the forecast level, reaching £1,763,635 after tax compared with £1,362,293.

The break-down of these figures shows clearly that the improvement is almost wholly attributable to share-dealing, profits from which rose by over £400,000 to £536,414. Dividends and interest received was only fractionally up at £2,339,401, while the portmanteau item of fees, commission and sundries was slightly lower than last year.

#### BRIGHT FUTURE FOR BERALT?

Companies formed to exploit wolfram deposits generally have a short life, though often a merry one. A company earning good profits in January may well find itself priced out of business in June as a result of the wide swings to which the price of the ore is prone. The exception is Beralt Tin and Wolfram, which has been working its Portuguese properties steadily for a generation, though with varying success in terms of profits. The reasons for Beralt's relative stability are several, but most important are its low cost structure and its flexibility in production as between tin and wolfram. Speaking at the annual meeting this week (p. 460) Mr. Gates underlined these points.

In the course of a fortnight at the end of September, the wolfram price ran up from 100s. to 160s. Since then it has relaxed to around the 130s. mark, but this is still considerably better than the 62s. 6d. quoted on the open market in September 1958.

As far as Beralt is concerned, this is an admirable price level. It is high enough for the company to make fair profits on a production of, say, 170 tons per month, but more important, it is not high enough to make it worth while for production to be restarted at many of the 700-odd mines which closed between 1955 and 1958. This statement only holds water, however, so long as Beralt can keep its costs low, and on this front Mr. Gates is fully confident.

On the question of flexibility, Mr. Gates emphasized that stepping up the output of tin would provide a much firmer base for Beralt's profits than anything that could be done in respect of wolfram. (Portugal, of course, is outside the I.T.A.) Beralt has two main sources of tin ore, Vale da Ermida and Argimela. The second of these is a large low-grade deposit, and the best method of exploiting it is still being sought.

Even now, much of the work on this property is of an exploratory nature, but costs are just about met by revenue. As tonnage output expands, the position will improve, and within a year or two Argimela should be making a useful contribution to profits.

Meanwhile, the bulk of Beralt's tin must come from the Vale da Ermida, and it is at this section that the company met disappointment nine months ago. The grade suddenly dropped and it was found that normal stoping methods were no longer economical. Within a short period of time, bulk mining methods were adopted, and since the beginning of 1959 over 100,000 tons of ore have been extracted from glory holes. Meanwhile, the underground labour force has been cut back, the bulk being transferred to wolfram production at the main mine. As long as the wolfram and tin prices remain at reasonable levels, therefore, Beralt's future appears bright, and the current price of around 35s. 6d. is by no means high.

**A Correction.**—On p. 1 of last week's supplement appeared a reference to an article by our South African Correspondent, which, it was stated, appeared on p. 11. This referred to p. 11 of the current issue of the *Mining Journal Quarterly Review*, not to the supplement.

**Cam and Motor 1959 Results.**—Slight improvements in tonnage milled and grade resulted in Cam and Motor improving its working profit from £399,361 to £401,108 in the year to June 30, 1959. Unchanged dividends totalling 40 per cent were paid during the year at a cost of £225,000. A start has been made with the building up of a new "Output Equalisation Reserve" which, says the chairman Sir Peter Bednall, is to be considered as part of the ore reserve held in the bank rather than in the ground. A sum of £54,960 has been transferred to this reserve for 1958-9, and it is hoped eventually to increase the total to a figure in excess of £75,000. Statement, p. 460.

**S. A. Coal Estates.**—In his circulated review, Mr. T. Coulter, chairman of S.A. Coal Estates, says that an examination of reserves in the Landau No. 3 colliery has shown that it will be possible to produce a marketable product by mining the extensive reserves of top coal, in conjunction with the remaining reserves of bottom coal in the colliery. The combined product will need treatment in a high-capacity washer, which has already been ordered. The total cost of the revised programme is put at about £500,000, but by carrying it out, it should be possible to defer consideration of the opening of the new Landau No. 4 until well into the 1970's, unless the intervening period sees a sudden upsurge in coal demand. Statement, p. 459.

**Rhodesia Monteleo: "No Prospects of Re-opening."**—The chairman of Rhodesia Monteleo Asbestos, Mr. J. Robinson, states that there is no prospect of reopening the mine in the foreseeable future. During the 1958-9 financial year, expenditure exceeded income by £580 after charging £6,000 for depreciation of stores and materials. The mine has been on a caretaking basis for six years.

**New Guinea Goldfields Earnings Lower.**—Profit of New Guinea Goldfields in the year to June 30, 1959, amounted to £A62,639, compared with £A84,654 in 1957-8. A dividend of 3d. per share from gold mining profits reserve is recommended, the same as last year. Meeting, Sydney, December 2.

**Renong Pays Same.**—An unchanged dividend of 6d. per stock unit is recommended by Renong Tin Dredging for the year to June 30 last. Profits after tax and taxation adjustments were £24,844, compared with £29,396 in the preceding twelve months, and the carry forward is increased by £3,317. Meeting, December 15.

Mining Engineer, aged 30-40 required for alluvial mining in West Africa. Please apply, giving particulars of age, qualifications, experience and copies of references to Box No. 646, *The Mining Journal*, 15 Wilson Street, Moorgate, London, E.C.2.

**DAVIES INVESTMENTS LTD.**, Bankers, still offer 7½ per cent on sums £20 to £500 (withdrawal on demand) with extra ½ per cent on each £500 unit. Details from Investment Dept. MN, Davies Investments Ltd., Danes Inn House, 265 Strand, London, W.C.2.

**REQUIRED**—An Assistant Mining Engineer for lode mine in Malaya with at least three years' underground experience. Salary according to experience. Furnished quarters, medical attention and passages are provided and there is a contributory Pension Scheme in operation. Application, with details of experience and copy references to Box No. 2960, c/o Charles Barker and Sons Ltd., Gateway House, London, E.C.4.

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#### GOVERNMENT OF UGANDA MINERAL DRESSER, GEOLOGICAL SURVEY DEPARTMENT

**Qualifications:** 1st or good 2nd class honours degree in mining, metallurgy or mineral dressing; or associateship of a recognized school of mines. Post-graduate mineral dressing experience essential unless candidate's original qualification is in mineral dressing.

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Apply Director of Recruitment, Colonial Office, London, S.W.1. State full name, age, qualifications, and experience. Quote BCD. 105/9/09/HI.

## EASTERN TRANSVAAL CONSOLIDATED MINES, LIMITED

(Incorporated in the Union of South Africa)

The 34th annual general meeting of Eastern Transvaal Consolidated Mines, Limited will be held on November 30 in Johannesburg.

The following is an extract from the review by the chairman, **Mr. L. P. Kent**, which has been circulated with the report and accounts:

The total profit earned by all the branches of your company during the year under review amounted to £173,801 compared with £186,924 for the previous year.

### Dividends

A dividend of 7½ per cent (4½d. per share) was paid for the year ended June 30, 1959.

### Capital Expenditure

Net capital expenditure during the year amounted to £77,149.

### Mining—General

Sinking of the Cesca sub-vertical shaft at the Agnes mine was suspended at a depth of 1,047 feet below the 17th level. Resumption of sinking will depend on the development results obtained in the lower levels of the mine.

The Prince Consort shaft at the New Consort mine has been equipped for hoisting down to the 33rd level and is presently being deepened to the 35th level. It is anticipated that this shaft will be sunk in stages to a depth of approximately 3,800 feet below the collar in order to exploit the area situated on the down throw side of a pegmatite intrusion to which reference was made in last year's technical advisers' report.

At the Sheba mine the high development values in the small zone of the Zwartkopje section, to which I made reference in my review for the year ended June 30, 1957, have persisted.

The total ore reserve increased by 17,400 tons to 260,600 tons and the value rose by 0.61 dwt. to 13.91 dwt. per ton. There was a decrease of 7,600 tons in the ore reserve at Sheba, but an increase of 1,400 tons at New Consort and 23,600 tons at Agnes.

Surface prospecting is being continued in the vicinity of the old Mount Morgan mine and work has commenced in the mine on a limited development programme to assist in estimating its potentialities. Extraction tests are being conducted at the Anglovaal laboratories on samples of the ore.

The native labour force is still inadequate to enable all your company's mills to be operated to capacity. The erection of additional housing for single native workers as required by the Native Labour Regulation Act, 1911, and the Native Administration Act, 1927, was continued during the year and improvements are being made to the recreational facilities available to native workers at all your company's mines.

### Timber Activities

In my review last year I reported two serious plantation fires in August and September, 1958. In terms of the company's insurance policy an amount of £18,942 was paid out by the underwriters.

Marketing of locally produced timber continued to be difficult, consequently milling operations were curtailed to a minimum. The combined operations

of your company's plantations and saw-mills resulted in a loss of £23,319 after providing £3,000 in respect of timber stocks as compared with a loss of £15,214 for the previous year.

### Farming Activities

The profit from farming activities amounted to £49, as again £1,114 for the previous year.

### Subsidiary Companies' Activities Frantzina's Rust Timber Plantations Limited.

At an extraordinary general meeting held on August 24, 1959, this subsidiary increased its authorized capital to £200,000 divided into 1,200,000 ordinary shares of 3s. 4d. each and then consolidated them into 400,000 ordinary shares of 10s. each.

At the date of this review having converted its loan into shares and taken

up its commitments in terms of the underwriting agreement, your company held 389,072 shares out of the total issued capital of 396,613 shares of 10s. each. Your company therefore now owns 98 per cent of the issued capital of this subsidiary.

The subsidiary incurred a loss of £47,957 for the year, after providing £6,000 in respect of timber stocks and £2,000 to cover possible bad debts, as compared with a loss of £23,499 for the previous year and I refer members to my remarks, contained elsewhere in this review, regarding the continued recession in the timber market.

### Swaziland Mining and Exploration Company, Limited.

During the year your company acquired the balance of the shares in this company thereby making it a wholly-owned subsidiary.

## HARTEBEESTFONTEIN

(Incorporated in the Union of South Africa)

### HIGHER WORKING PROFIT

#### MR. B. L. BERNSTEIN ON INCREASED DEVELOPMENT PROGRAMME

The 10th annual general meeting of Hartbeestfontein Gold Mining Company Limited will be held on November 26 in Johannesburg.

The following is the circulated review of the chairman, **Mr. B. L. Bernstein**:

The working profit from both gold and uranium production increased during the financial year ended June 30, 1959, compared with the previous year. Working profit from gold increased by £80,067 to £3,871,539 and that for uranium by £75,239 to £3,122,323. After appropriations of £2,424,247 for capital expenditure, £653,686 for repayment of loans and £327,726 for taxation, a balance of £3,510,184 was available for distribution as dividends. Dividends equivalent to 7s. 0d. per share absorbed £3,150,000 leaving a surplus of £360,184 to be added to the balance of £1,219,114 brought forward from the previous year.

The increase in profit, together with a reduction in the previously estimated capital expenditure during the year under review, has resulted in the company's assessed loss for tax purposes being absorbed a few months earlier than was forecast in my last review and it has been necessary, therefore, to make an initial provision of £327,726 for tax liability to June 30, 1959. As the assessed loss for income tax purposes has now all been absorbed, members will appreciate that taxation and State's share of profits for the year ending June 30, 1960, will have to be paid on the full year's profit less capital expenditure incurred during the year.

### Working Costs Reduced

The grade recovered showed a small decrease compared with the previous year. Gold recovery declined by 0.046 dwt. to 10.921 dwt. per ton and uranium recovery by 0.002 lb. to 0.822 lb. per ton. However, the increased milling and treatment rate, which averaged 87,000 tons and 106,833 tons per month,

respectively, resulted in an increase in the gold and uranium oxide recovered. Working costs during the year decreased by 6d. per ton milled and 5d. per ounce fine as compared with those of the previous year and averaged 64s. 8d. per ton and 118s. 5d. per ounce fine of gold, respectively.

The Atomic Energy Board has consented, in terms of section 28 of the Atomic Energy Act, to the publication of current information on the total price received from the sale of uranium to the Combined Development Agency. Shareholders will have noticed that treatment costs at your mine at 16s. 7d. per lb. for the year under review are amongst the lowest in the industry. If treatment costs of this order can be maintained, your mine will be well placed to compete in the open market with other world producers when its contract expires on December 31, 1966.

### Development

During the year under review the sinking of No. 2A sub-vertical shaft and No. 3 shaft from surface was completed and the shafts were connected by a transfer level approximately 5,730 feet below the surface. All the main stations have been excavated and development of the deeper portion of the mine is proceeding as rapidly as possible. Up to September 30, 1959, 7,545 feet of reef development had been accomplished in the deeper area and of this 5,825 feet, equal to 77.2 per cent, proved payable at 322 inch-dwt. and 23.23 inch-lb. over a channel width of 7.3 inches.

The payability of the Vaal reef so far encountered in the deeper area of the mine adjacent to No. 2A sub-vertical shaft and No. 3 shaft has been lower than anticipated and it has become necessary, therefore, to increase the planned rate of development at these shafts to an average of 9,000 feet per month during the current financial year.

This will ensure that sufficient stope faces will be available to replace depletion in the shallow area and to expedite the rate of build-up of the tonnage milled. Included in this development programme are two high-speed twin haulages, one being advanced westwards on the 25th level towards borehole HB 18 and the other southwards on the 29th level towards borehole HB 15. These haulages will enable exploratory reef development to be undertaken in blocks of faulted ground lying about 5,000 feet west and south, respectively, of No. 2A shaft. The 29th level haulage south will serve, in due course, as a connecting haulage between No. 2A shaft and the new No. 4 shaft, which it is planned to start sinking in July, 1960.

In order to obtain additional geological information of the deeper area three boreholes are being drilled from surface. The positions of these boreholes, numbered HB 23, HB 24 and HB 25, are indicated on the plan of the underground workings. On September 30, 1959, the boreholes had reached a depth of 5,533 feet, 5,280 feet and 4,410 feet respectively. Boreholes HB 23 and HB 24 were in the Gold Estates beds while borehole HB 25 was in Ventersdorp lava.

#### Capital Expenditure

The increased development programme which has become necessary will entail additional capital expenditure and the estimate of £8,500,000 for the three years to June 30, 1960, which was given in last year's review, will be exceeded. During the current financial year it is estimated that capital expenditure will be about £2,500,000. This sum will include, in addition to expenditure on development work, expenditure on preparatory work connected with No. 4 shaft, and on improvements and modifications to the uranium plant to increase its efficiency. Consideration is being given to the advisability of financing some of this capital expenditure by raising long term loans on the security of houses owned by the company.

#### Milling Rate Increased

The programme to increase the capacity of the reduction plant to 130,000 tons per month has been completed. The milling rate during the present financial year has already increased from 88,000 tons in July to 91,000 tons in September, and it is expected that a milling rate of 120,000 tons per month will be achieved during the first quarter of 1960 when about one-third of the tonnage will be obtained from the deeper area.

Since production of uranium commenced in November, 1956, it has been necessary to draw an average of some 19,500 tons per month from accumulated slime to supplement the ore from current production. As current production increases, less tonnage will be drawn from this source.

Your company has acquired the mineral rights of that portion of the farm Mapaiskraal No. 441, adjoining the south-western portion of the mining lease area, which lies north of the Kromdraai fault, a fault which is estimated to traverse the farm in an east-west direction. Application will be made in due course for a mining lease over this area of approximately 437 claims. In order to assist in the exploitation of the additional claims, No. 4 shaft has been resited south of the position previously selected.

## SOUTH AFRICAN COAL ESTATES (WITBANK) LIMITED

(Incorporated in the Union of South Africa)

### MR. T. COULTER REVIEWS FUTURE MINING POLICY

The thirty-ninth annual general meeting of South African Coal Estates (Witbank) Limited will be held in Johannesburg on November 24.

The following are extracts from the review by the chairman, **Mr. T. Coulter**, which has been circulated with the annual report and accounts:—

I have pleasure in reviewing the affairs of the company for the year ended June 30, 1959.

#### Accounts

The company's gross profit on coal mining improved by £16,097 to £419,427, reflecting the results of a slightly higher output and some additional benefit from the price increase granted in November, 1958.

After adding sundry items of revenue and deducting expenses, the profit for the year, before tax, was £426,174. A provision of £116,500 was made for taxation and £309,674 was carried to the appropriation account, compared with £292,382 for the previous year.

Unappropriated profits brought forward, including a small tax adjustment, at £110,306, made a total of £419,980 available for appropriation.

Capital expenditure incurred during the year amounted to £41,155, of which £20,613 was spent on the major capital programme which the company now has in hand. A further appropriation of £80,000 was made for future capital expenditure and this account now stands at £480,000 in the balance sheet. Although heavy capital demands will be made on the company over the next few years, the general profit and cash positions are sound and warranted an increase in the dividend from 3s. 9d. to 4s. per share. This distribution absorbed £200,000, leaving a slightly reduced unappropriated profit of £98,825 to be carried to the balance sheet.

#### Operations

The company's total sales tonnage for the year, at 1,749,914 tons, showed an increase of 9,919 tons compared with that of the previous year. The improved position is due to the heavy steam coal sales which were made during the latter part of 1958 when adequate truckage became available for the transport of coal for the first time in many years; but a proportion of the increased demand represented stockpiling and the higher sales level was not maintained in 1959. This was to be expected, as a measure of the quieter economic conditions prevailing in the country.

Comparative sales outputs of the company's two producing pits are as follows:

	Yr. ended 30.6.1957	Yr. ended 30.6.1958	Yr. ended 30.6.1959
	Tons	Tons	Tons
Landau No. 3 ..	1,187,869	1,219,843	1,236,516
Navigation ..	502,723	520,152	513,398
Totals ..	1,690,592	1,739,995	1,749,914

In addition to the above, 130,937 tons of steam coal middlings were despatched this year to The South African Iron and Steel Industrial Corporation Limited (Iscor), the corresponding tonnage for 1958 having been 160,420 tons.

As before, the entire steam coal output of Landau No. 3 was disposed of through the Transvaal Coal Owners' Association, while all blend coking coal and steam coal middlings from Navigation were sold to Iscor.

**Navigation Mine:** The sales output of blend coking coal decreased by 6,754 tons to 513,398 tons, owing to a reduced demand by Iscor during the months from September to December inclusive. It is probable, however, that during the current financial year Iscor's demands will rise above previous levels.

The company's output of blend coking coal has been drawn in the past in varying proportions from both the No. 2 and the No. 5 Seams. During the year, 20.9 per cent. of output was drawn from No. 2 Seam and the balance from No. 5. Mining conditions, particularly in the No. 5 Seam, remain good.

As mentioned last year the company has acquired the right from Witbank Colliery Limited to mine No. 5 Seam on a royalty basis from a small portion of the farm Witbank No. 61. The total tonnage of saleable coal (i.e. blend coking coal and middlings) extracted from this lease area was 209,401 tons.

An agreement has now been entered into with The Clydesdale (Transvaal) Collieries Limited by which the company has acquired the right to mine No. 5 Seam on a royalty basis from certain portions of the farm Blaauwkrans No. 62. It is expected that mining in this new lease area will commence early in the coming year.

**Landau No. 3 Mine:** The total sales tonnage, at 1,236,516 tons of steam coal, showed an increase of 16,673 tons over the previous year and would have been considerably more but for the easing of demand in recent months. For the first time for many years it was necessary to dump saleable coal, and during the last seven months, 31,567 tons of duff coal had to be dumped.

#### Future Mining Policy

In last year's review I discussed in detail the reasons which had led the company to review its original proposals to establish a new colliery to be known as Landau No. 4. Since then our examination of the alternative plan of mining the extensive reserves of lower quality top coal at Landau No. 3 has been satisfactorily completed. As a result the company's technical advisers have recommended a programme to mine the top coal reserves in conjunction with the remaining reserves of bottom coal in the colliery. A marketable product will be obtained by treating the mixed output of top and bottom coal in a high capacity washing plant for which an order has already been placed.

Work has also started on the sinking of a new incline shaft which will carry a belt conveyor feeding into the washing plant. Experiments conducted recently in the mine have demonstrated the feasibility of mechanizing the loading and transport of coal from the face to the existing tub haulage system, and machinery for this purpose will be installed in due course.

The cost of replanning and equipping the mine and installing the washing plant is estimated at £500,000, which the company will be able to meet from its own resources.

This expenditure will enable the company to continue mining from Landau No. 3 for about 15 years and, unless there is a considerable upswing in the demand for coal, we will not need to consider the establishment of the new Landau No. 4 colliery until the 1970's.

#### General

In November, 1958, the Transvaal coal mining industry was granted a price increase of 1s. 3d. per ton, representing a

portion of the claim which had been made to the Price Controller. Because of the long period which elapsed between the submission of the claim and the increase in price and because of a further rise in costs since then, the net benefit today is meagre.

A demand by the Mining Union's Joint Committee for a general increase in wages was referred to a Conciliation Board as a result of which certain wage adjustments were agreed in February, 1959.

*Copies of the annual report and accounts may be obtained from the London office of the company, 40 Holborn Viaduct, E.C.1.*

## BERALT TIN & WOLFRAM

### MR. F. GATES'S SPEECH

The thirty-first annual general meeting of Beral Tin and Wolfram, Ltd., was held on November 3 in London.

**Mr. F. Gates**, Chairman, presided, and in the course of his speech said:

The year under review was a difficult one for all producers of wolfram. Many wolfram mines all over the world, which had been brought into production as a result of the high prices ruling during the Korean crisis, were compelled to close down. In the United States, for example, where over 700 mines were producing tungsten ore in 1955, only two of those mines were working at the end of 1958, and in one of these tungsten ore was only a by-product.

It says much for the stability of our enterprise that we found it possible during this difficult period to continue operations without cutting down our technical staff in Portugal, though some reduction in our labour force as compared with the numbers employed two or three years ago has been unavoidable.

#### Improved Prospects for Wolfram

The curtailment of production all over the world and the gradual consumption of accumulated stocks have recently led to somewhat firmer conditions in the wolfram market. The price rose to 95/- per unit at the end of November, 1958, and fluctuated between limits of 80/- and 105/- until September last, when a sudden flurry, which illustrated the fact that there was not much wolfram available for prompt delivery apart from Government stocks, drove the price up from 100/- to 160/- in the course of a fortnight.

This sudden price increase enabled the company to dispose at a satisfactory price of a considerable part of the wolfram stocks it had for some time been holding, to which I referred at our General Meeting last year.

Some months previously, in anticipation of firmer market conditions, the Board had given instructions for our production of wolfram to be gradually increased.

For the time being, therefore, the Company's prospects look brighter, but you will realize that the maintenance of this improvement depends upon the wolfram price remaining at a satisfactory level.

I can assure you that the company's reserves of wolfram ore are sufficient to meet any demand likely to be made upon them. I said at the General Meeting in October, 1956, that not only did ample reserves for years to come still remain

on the east side of the Main Fault between Main Adit Level and Level 2, which is over 500 feet lower, but an extensive system of wolfram veins of good grade had been disclosed west of that fault both above and below Main Adit Level. Further development of those veins has yielded good results and current production of wolfram is coming almost entirely from this area.

In short, we have large reserves of wolfram ore and a well equipped mill, known as the River Mill from which wolfram concentrates of high grade can be produced at a comparatively low cost per unit. I have no doubt, therefore, as to our ability to make satisfactory profits so long as the wolfram market can absorb the requisite tonnage of our concentrates at a reasonable price level.

#### Tin Ventures

If we are able to secure an economic production of tin concentrates this would be a stabilizing factor that would greatly strengthen the company's position.

Work has been continued energetically on the tin bearing deposits both at Vale da Ermida which is adjacent to our main mine and at Argimela which is some 25 miles distant by road.

At Vale da Ermida production by normal underground methods was stepped up from 68 tons of concentrates in April 1958, to 86 tons in September, and during those six months operations there made a contribution of over £20,000 to overheads. During the latter half of the financial year, however, the grade fell in a most disappointing way and the Board came to the conclusion that operation of the deposit by normal stoping methods was not economically practicable at the current price for tin.

The fact that this area contains large quantities of tin has been demonstrated by the volume of production from underground mining but the problem of finding a method of mining and treating the ore to give a sufficient economic return at the present tin price has yet to be solved.

Operations at Argimela, which are still of an exploratory nature for the most part, are now virtually self-supporting and the position may be expected to improve with increased throughput. Much work still remains to be done on the development of this property and on improvement and expansion of the milling plant, but I am confident that within a year or two it will be making a useful contribution to our profits.

The Report and Accounts were adopted.

## THE CAM AND MOTOR GOLD MINING COMPANY (1919) LTD.

### CHAIRMAN'S STATEMENT

The 40th annual general meeting of The Cam and Motor Gold Mining Company (1919) Limited will be held on December 2 in Salisbury, Rhodesia.

The following is an extract from the circulated statement of the chairman, **Sir Peter Bednall, K.B.E., C.B., M.C.:**

The Working Profit at Cam and Motor Mine and at Pickstone Mine amounted to £491,675, in comparison with £487,923 for the previous year — a negligible increase. These figures do not, however, include the amount placed to Output Equalization Reserve. As stated last year, the Directors' policy of mining within Ore Reserves was continued and will be continued in the future.

Revenue from retreatment of the Slimes Dump amounted to £230,692, a figure slightly in excess of the previous year. The Working Profit from this source amounted to £165,638, which is £689 less than the previous year.

During recent months the working face of the old slimes dam, which is being retreated, has been passing through a zone of very finely divided slime. Considerable difficulty has been experienced in treating this slime in the flotation plant, with the result that profits earned from this source may be reduced.

Total development footage for the year amounted to 33,876 ft., of which 19,101 ft. were primary. This is an increase in primary development of 6,111 ft. or 47 per cent over last year. Of the 8,127 ft. sampled, 29 per cent or 2,349 ft., were payable.

Ore reserves at Cam and Motor Mine showed a minor drop of 20,800 to 1,230,500 tons at 7.0 dwts. As against this, the Pickstone reserves have increased by roughly 12,800 tons. Ore reserve grade at Cam is down by 0.2 dwts.

The average value of ore milled for last year was 7.09 dwts. Compared with last year this is an increase of 0.41 dwts.

#### Pickstone Mine

I am happy to be able to report good progress. The milling rate of approximately 7,000 tons per month was maintained and the extraction rate again improved from 82.5 to 85.8 per cent. A further increase in primary development from 3,050 to 4,879 ft. for last year has been achieved. Footage sampled amounted to 2,867, of which 576 ft. were payable at an average value of 7.5 dwts. over 66 in., compared with 5.1 dwts. and 67 in. for the previous year.

The heartening improvement in development values and the discovery of hitherto unknown payable reefs, has encouraged your Board to approve a recommendation to increase still further the scale of development during the current year, in order to determine the possibilities of future expansion.

The average value of ore milled was 4.37 dwts., compared with 4.23 for the previous year.

Your Company continues to make every effort to widen the scope of its mining activities. During the year under review the Company was offered, and accepted, an interest in the Lonrho Exploration Company, Limited, which was formed in order to co-ordinate prospecting activities of companies within the Lonrho Group.

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